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Bottom Longline Fishing for Sharks in the Northwestern Hawaiian Islands

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Bottom Longline Fishing for Sharks in the Northwestern Hawaiian Islands

for

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ABBREVIATIONS

D1-D2	distance between the first and second dorsal fins
FL	fork length
fm	fathoms
ft	feet
Honolulu Lab	Southwest Fisheries Science Center Honolulu Laboratory, NOAA Fisheries
in	inches
lb	pounds
m	meters
MHI	Main Hawaiian Islands
mm	millimeters
nm	nautical miles
NOAA Fisheries	National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce
NWHI	Northwestern Hawaiian Islands
PIRO	Pacific Islands Regional Office, NOAA Fisheries
TL	total length

INTRODUCTION

In 1998, the F/V *Anna C* began using bottom-set hook and line (bottom longline) gear to harvest sharks in the nearshore waters of the Main Hawaiian Islands (MHI) and Northwestern Hawaiian Islands (NWHI). Although bottom longline gear is commonly employed in the shark fishery along the U.S. East Coast and the Gulf of Mexico, its use in targeting nearshore sharks in a commercial fishery was new to Hawai'i.

Prior to the introduction of this fishery to Hawai'i, much of the catch of nearshore sharks was made in shark control and research programs, which also generated most of the available biological information on nearshore sharks in Hawai'i. Between 1959 and 1976 six shark control programs were carried out in Hawai'i, most of them conducted or supported by the State of Hawaii (Ikehara 1961, Tester 1969, Norris and Harvey 1969, Fujimoto and Sakuda 1972, Naftel et al. 1976, Naftel 1976). All the programs were limited to the MHI and all had the goal of reducing the number of sharks in Hawai'i's nearshore waters (or assessing the ability to do so) in order to reduce the frequency of shark attacks. These programs are reviewed by Wetherbee et al. (1994). The programs used standardized bottom longline gear and relied on measures of catch per unit of fishing effort as indicators of shark abundance. The programs also gathered information on shark distribution, diet, and reproduction. In all, 2,849 sharks were captured (eight sharks per 100 hooks), and 1,819 pups were removed from pregnant sharks (Wetherbee et al. 1994). Some of the programs investigated the marketability of Hawai'i-caught shark products, with the aim of developing a commercial fishery that would obviate the need for a government shark control program (Tester 1969, Fujimoto and Sakuda 1972, Naftel 1976). In the NWHI, sharks were studied as part of the Resource Investigations in the Northwestern Hawaiian Islands, a program conducted from 1978 to 1980 (De Crosta et al. 1984, Radtke and Cailliet 1984). The data collected in the research and control programs described above have been used in a number of additional studies and syntheses. These include studies by Lawrie (1978), who estimated shark abundance around Hawai'i; Wass (1971, 1973), who examined the biology of the sandbar shark (*Carcharhinus plumbeus*) and the grey reef shark (*C. amblyrhynchos*); Crow et al. (1996), who summarized shark records and distributions; Wetherbee et al. (1997), who examined the biology of the Galapagos shark (*C. galapagensis*); Lowe et al. (1996), who described the diet and feeding behavior of the tiger shark (*Galeocerdo cuvier*); and Wetherbee et al. (1997), who described the distribution, reproduction, and diet of the grey reef shark. Using acoustic tagging techniques, investigations have been made of the movements of tiger sharks in the waters of Hawai'i, including the NWHI (Tricas et al. 1981) and the MHI (Holland et al. 1999). The catch of tiger sharks in Hawai'i's pelagic longline fishery is described in Polovina and Lau (1993).

Bottom longline gear consists of a length of weighted line with baited hooks that is set on or near the ocean bottom. At the time of the *Anna C*'s fishing operations, federal and Hawaii State regulations defined "longline" as a horizontal line with hooks that is suspended in the water column with floats. Consequently, existing regulations on the use of pelagic longline gear (e.g., fishing prohibitions within certain areas around the MHI and NWHI) did not apply to bottom longline gear. Because of the lack of controls on the use of bottom longline gear, concerns were raised about the potential for bottom longlining operations, such as those of the *Anna C*, to overfish nearshore shark resources, take protected marine species such as the endangered Hawaiian monk seal (*Monachus schauinslandi*), and adversely affect coral reef habitat.

Through a cooperative effort between the Pacific Islands Regional Office of the National Marine Fisheries Service (PIRO) and Junior Cross, the owner and operator of the *Anna C*, a biologist was contracted to accompany the commercial bottom longliner on a trip in August-October, 1999, to observe its fishing operations. This report describes the observations made during that trip. The *Anna C* was sold shortly after that trip, and no commercial bottom longline fishing is believed to have taken place in the waters around Hawai'i since then.

All fishing during the trip took place in the NWHI except for one set that was made on Penguin Bank, near the island of Molokai in the MHI. Information collected during the trip included descriptions of fishing gear configuration, fishing methods, and fish handling and processing methods; measurements of fishing effort, catch, and sexes, lengths, and weights of captured sharks; disposition of captured sharks and incidentally caught species; observations of the condition, stomach contents, and reproductive status of captured sharks; and observations of interactions with protected marine species. In addition, tissue samples of sharks were taken for future DNA and fatty acid analysis and a number of sharks were tagged.

This cooperative effort allowed the National Marine Fisheries Service (NOAA Fisheries) to obtain information on a fishery new to Hawaiian waters. The data collected will help fishery scientists and resource managers to evaluate the potential benefits and adverse effects of fishing with bottom longline gear in Hawaiian waters.

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OBSERVATION AND SAMPLING METHODS

Information for each set was recorded on set forms and entered into a computer database situated in the wheelhouse. The gear set and retrieval times, weather conditions, sea surface temperature, and the location (latitude and longitude, as determined by GPS) and depth of each buoy line were recorded. The number of hooks, buoys, and anchor weights per set, along with the length of the groundline (nm) and the total soak time, were also recorded. The numbers of hooks lost, hooks straightened (due to sharks or hang-ups with the bottom), and incidences of the gear parting (due to bite-offs or hang-ups with the bottom) were recorded. With the captain and crew's assistance, an estimate of the percentage of bait return was recorded at the completion of each set.

The catch was recorded by species, number, condition upon capture (dead versus alive, bite marks on the body, missing or bitten fins, prior hook injuries), and disposition (retained, discarded damaged, lost, released alive). For all sharks that were boated and not seriously damaged, the sex was identified and morphometric measurements were taken using a set of measuring calipers (200 cm) and a tape measure (100 cm). Calipers were used to measure total length (TL), fork length (FL), and occasionally on the larger tiger sharks, the distance between the first and second dorsal fins (D1-D2). The tape measure was used for most of the D1-D2 measurements and to measure the clasper lengths of male sharks. These measurements were made based on descriptions by Garrick (1992). All measurements were performed on the left side of the shark and measured anterior to posterior (head to tail), which proved to be the fastest and most accurate method. The captain and crew were very helpful in positioning the sharks for accurate measuring, which helped to speed the measuring procedure and minimize the time elapsed before the crew could begin processing of the catch. The system allowed for the measurement of almost all of the captured sharks.

Several sandbar, Galapagos, and tiger sharks were weighed using a Dillion 4,000-lb scale before and after processing to determine product recovery weights.

The stomach contents of about 95 percent of the captured sharks were observed and identified on deck and stomach samples of 11 tiger sharks were collected for later laboratory analysis.

The number of pregnant sharks was recorded, and for each pregnant shark, the number, sizes, and condition of its pups and embryos were recorded.

Tissue samples were collected from 52 sharks, including each of the five captured species, for future DNA analysis for the purpose of stock identification (Appendix 3). Liver samples were collected from 53 tiger sharks for future fatty acid analysis for the purpose of studying predation on Hawaiian monk seals by nearshore sharks (Appendix 4). The results of the DNA and fatty acid analyses are not presented here.

Tagging was done on an opportunistic basis on sharks that were released by the crew and on pups that were recovered from pregnant females. Fifteen sharks were tagged during the trip: 14 tiger sharks (including 5 pups) and one sandbar shark (Appendix 2). Sharks were tagged on the left side just below the dorsal fin. All tagging information was given to Tom Kazama of the Southwest Fisheries Science Center Honolulu Laboratory (Honolulu Lab).

RESULTS

Vessel and Fishing Gear

The fishing vessel *Anna C* is a steelhulled Gulf shrimper built in 1978 (Figure 1). The vessel is 22.8 m (75 ft) in length with a beam of 6.1 m (20 ft) and accommodates nine crew members. The vessel has two longline reels (main and backup) for setting the monofilament groundline. The groundline ranged from 3.5 mm to 4.2 mm in diameter (700 to 1400 lb test), but most of the groundline used was 3.8 mm in diameter (900 lb test). The gear used included line that had previously been used as pelagic longline to fish for swordfish and tuna and line that had been used as bottom longline by the *Anna C* to fish for sharks off the U.S. East Coast and in the Gulf of Mexico (J. Cross, *Anna C* captain, pers. comm.).

Figure 1. F/V *Anna C.*

Two types of gangions, attached to the groundline via snap-on clips, were used. The first type was constructed of 3.0 - 3.6 m (9 - 12 ft) lengths of 3.8 mm monofilament line with 8/0 steel swivels and 16/0 Mustad circle hooks attached to the end. The second type was constructed of 3.0 m (9 ft) lengths of monofilament line attached to 46 cm (18 in) lengths of 1.5 mm steel leaders. These gangions had larger circle hooks attached, 18/0 to 20/0 in size. The steel leader gangions were used on only two sets during the trip.

Buoys were set with the fishing gear as a means to retrieve the groundline from the bottom. Buoys were deployed at 30-hook intervals and double-buoys were used at each end of the set. Two types of buoys, submersible hard floats and foam (cone-shaped) bullet floats, were

snapped onto the groundline when deploying the gear. The use of buoys on each section of gear was observed to be useful for retrieving the groundline when hang-ups with the bottom occurred and when the groundline parted. The buoyline consisted of ¼ inch polypropylene line from the bottom up to a depth of about 22 m (12 fm) and 2.1 mm monofilament line from 22 m to the surface. The monofilament line helped minimize surface drag from currents. At the end of each set, 13.6 kg (30 lb) lead weights were deployed to secure the gear to the bottom. To further reduce gear movement, 4.5 kg (10 lb) weights were attached to the groundline at intervals of every 10 gangions. These weights were used instead of traditional longline anchors. They were determined by the vessel captain to be best suited the type of bottom being fished and to reduce the potential impact the gear might have on the bottom habitat (J. Cross, pers. comm.).

The vessel was crewed by the captain and four other crewmembers.

Fishing Methods

The bottom longline gear was set during the early evening and fished overnight. The groundline was paid out from the main reel on the upper deck, across to a pulley which directed the line down and out from the stern of the vessel. There, a crewman manned each side of the baiting table, which held the bait and two magazines of gangions containing approximately 100 hooks each. A third crewman stood by to deploy the buoys when directed. As the groundline was paid out from the main reel to the stern of the vessel, gangions with baited hooks were clipped onto the groundline at line intervals of approximately 36.6 m (20 fm).

Hauling of the gear started the following morning and lasted until the middle or late afternoon. Hauling was performed on the starboard side, just aft of the wheelhouse, where there was a control station for driving the vessel and operating the groundline reel. After retrieving the end buoys the set groundline was attached to the free end of the groundline on the reel and run through several pulleys around and up to the upper deck. As each empty hook came to the vessel, its gangion was removed from the groundline and placed in a magazine rack along the starboard side of the vessel. Hooks were retrieved at an average rate of about one every 20 to 30 seconds.

When a catch came up, the gangion was unclipped and moved along the side of the vessel to the main deck area. Small to medium sized sharks were boated using a gaff hook or by pulling the shark up and over the rail by the gangion. The larger sharks were subdued with a bang stick prior to being hauled aboard with a power gaff.

Bait consisted primarily of shark belly meat cut into square or rectangular pieces of approximately ¼ - ½ lb each. On two sets spotted eagle ray and moray eel, of which five pieces were incidentally caught during the course of the trip, were used as bait. Set 8 had 15 hooks baited with a mix of moray eel and spotted eagle ray. No difference in catch was observed. Set 17 had approximately 150 hooks baited with spotted eagle ray mixed throughout the set. This represented 38 percent of the baited hooks for that set and resulted in the highest number of sandbar sharks (108) caught in any one set during the trip.

The captain noted that in the past, moray eel and spotted eagle ray bait were observed to attract more sharks than shark flesh. Interestingly, the crew discovered spotted eagle ray spines embedded in the jaws or in the ventral body area behind the heads of some sharks. These spines ranged in size from 3 cm to 10 cm, and the majority was found in tiger and Galapagos sharks. As indicated in a later section, moray eels were found to be a common item in the stomachs of the sharks caught.

Shark Processing and Landings

After being measured and sampled by the observer, retained sharks were immediately finned and bled by the crew. Sharks were bled by removing the caudal fin near the caudal peduncle. Smaller sharks (sandbar, Galapagos, grey reef, and blacktip (*Carcharhinus limbatus*)) were processed into "tubes," which involved removing the head and guts and trimming the belly flaps. The tubes were rinsed clean, lowered into the hold, and hung to freeze. They were later moved to more permanent freezer storage. The larger sharks (Galapagos and tiger) were processed into skin-off loins weighing 4.5 to 13.6 kg (10 to 30 lb), which involved filleting and deep-skinning (to remove the layer of dark meat adjacent to the skin). The loins were rinsed and placed into baskets to remove excess water. They were then placed onto freezer trays and put in the freezer hold. The loins were later glazed and stored on plastic liners until being boxed. The freezing and storage process was completed by the morning following the day of the haul.

Fins from all retained sharks were removed, graded, and stored in the freezer hold. Meat from the abdomen wall was retained for use as bait. The jaws and skins of some tiger sharks were also retained.

The catch was offloaded in Honolulu into a freezer container. The offload weight for the trip was approximately 20,131 kg (44,380 lb) of tubes and 3,370 kg (7,430 lb) of loins. The weight and number of shark fins landed were not determined. Most of the landed product, including the fins, was sold to a dealer in Hawaii, who is believed to have shipped it to Mexico.[1] The jaws were sold locally and the shark skins were given away locally (for drum making) (J. Cross, pers. comm.).

Fishing Effort

A summary of fishing effort and fishing conditions during the trip follows.[2] A map of the Hawaiian archipelago and the areas fished is shown in Figure 2. Further details of the characteristics of each set are provided in Table 1.

- During the course of the trip, a total of 21 days were fished, with one set made during each day fished.
- Twenty of the 21 sets were made in the NWHI and one was made in the MHI.
- The 20 sets in the NWHI were made in the following six areas: Necker Island (1), Gardner Pinnacles (13), St. Rogatien Bank (2), French Frigate Shoals (2), Nihoa West-1 (1), and Nihoa West-2 (1) (the latter two are not commonly accepted names, but rather descriptors used in this report for two areas west of Nihoa that were fished).
- The single set in the MHI was made on Penguin Bank.
- No two sets were made in the same location.
- Fishing depth ranged from 18 to 45 fm, with an average of 34.5 fm.

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[1] Prior to this trip, all the sharks were processed into loins (rather than tubes), and the primary buyer was on the U.S. mainland (J. Cross, pers. comm.).

[2] The vessel actually came to port in Honolulu twice in the middle of the trip – once after experiencing mechanical problems at Necker Island (Set 1), and a second time after the single set was made at Penguin Bank (Set 2), but no fish were offloaded at those times. The set at Penguin Bank was done in part for the benefit of a guest video crew, so the fishing methods used during that set might not have been typical. The length of the last portion of the trip (Sets 3 - 21), about 25 days, was a typical trip length for the vessel (J. Cross, pers. comm.).

- The majority of sets were made over smooth, hard, rocky bottom with patches of sand, a habitat type that was preferred because it allowed the gear to be hauled with a minimum of problems.
- All sets but one were deployed parallel to the depth contours around the edges of the bank or shoal being fished. The remaining set (Set 6) was a test set to determine the bottom type and the presence of sharks across the shallow area of Gardner Pinnacles.
- Weather during the entire trip was calm – Beaufort 3 and 4, with two days at Beaufort 2.
- Sea surface temperatures ranged from 79.8° to 81.7° F.
- Set lengths were between 2 and 10.4 nm.
- Soak time ranged from 10 hours 30 minutes to 23 hours 10 minutes, with an average of 18 hours 30 minutes.
- The total number of hooks set was 7,922 (7,506 in NWHI), the average number of hooks set per day was 377, and the number of hooks per set ranged from 100 to 450.
- 494 hooks were lost (6.2% of the total number set), with a range of 6 to 75 hooks lost per set.
- The gear parted an average of 4 times per set and the number of straightened hooks averaged 6 per set.
- Bait return for most sets was relatively low, averaging about 20 percent.

Figure 2. Map of Hawaiian archipelago.

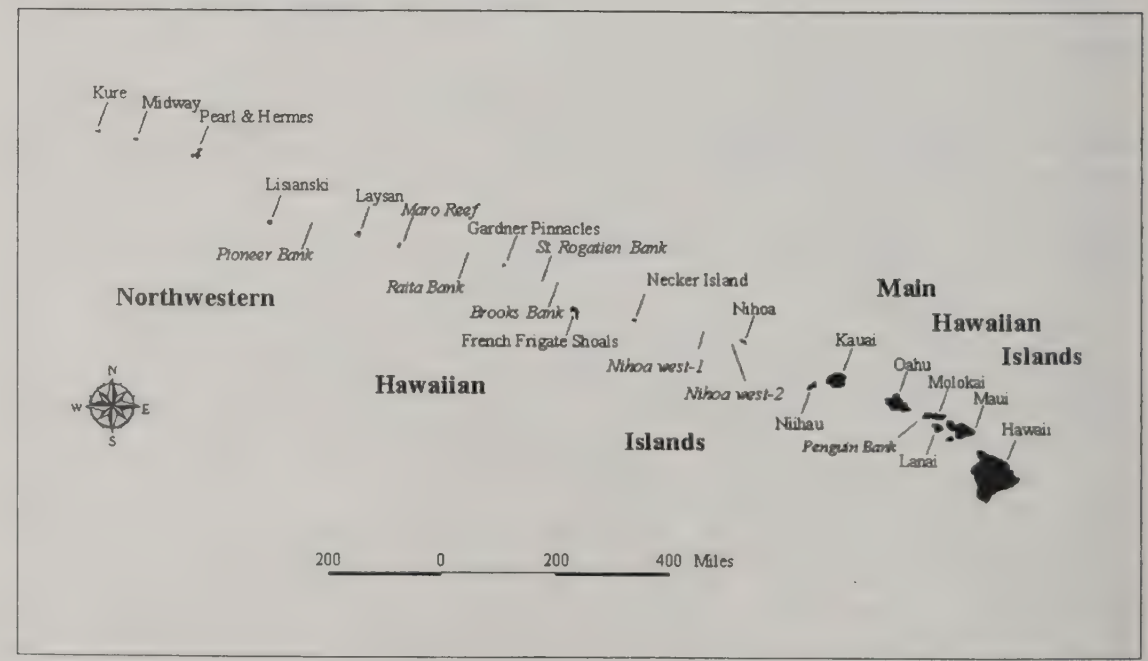

Table 1. Set characteristics.

Set no.	Set date	Set times begin - end	Haul date	Haul times begin - end	Soak time (hours)	Begin set position latitude	Begin set position longitude	End set position latitude	End set position longitude	Set length (nm)	Ave. depth (fm)	No. hooks
Necker Island												
1	8/29/99	1810 - 1935	8/30/99	0830 - 1635	14:20	23 31.8'	164 30.8'	23 38.9'	164 33.1'	7.8	30.8	412
Penguin Bank												
2	9/11/99	2210 - 2335	9/12/99	0840 - 1545	10:30	21 06.7'	157 35.6'	21 02.4'	157 41.0'	8.4	36.8	416
Gardner Pinnacles												
3	9/22/99	1805 - 1930	9/23/99	0855 - 1630	14:50	29 49.4'	167 53.6'	24 56.5'	167 55.8'	7.2	37.8	360
4	9/23/99	1755 - 1920	9/24/99	0925 - 1545	15:30	24 57.7'	167 56.4'	25 04.6'	167 55.3'	7.2	33.3	360
5	9/24/99	1755 - 1925	9/25/99	0905 - 1550	15:10	25 05.4'	167 56.8'	25 11.1'	168 03.1'	8.0	31.0	390
6	9/25/99	1705 - 1732	9/26/99	0945 - 1115	16:40	25 05.1'	168 02.8'	25 03.3'	168 02.4'	2.0	18.5	100
7	9/26/99	1759 - 1930	9/27/99	0930 - 1420	20:21	25 11.6'	168 04.4'	25 10.9'	168 12.5'	8.2	30.5	394
8	9/27/99	1815 - 1930	9/28/99	0940 - 1700	22:45	25 04.7'	168 16.9'	25 10.9'	168 12.8'	7.4	40.0	360
9	9/28/99	1810 - 1940	9/29/99	0845 - 1715	23:10	25 02.0'	168 16.8'	24 54.7'	168 11.1'	9.2	34.0	420
10	9/29/99	1950 - 2120	9/30/99	1015 - 1545	19:55	24 52.7'	168 09.7'	24 45.5'	168 08.2'	7.3	36.8	420
11	10/1/99	1755 - 1950	10/2/99	0945 - 1445	20:50	24 44.0'	168 07.9'	24 36.3'	168 05.5'	8.4	33.7	420
12	10/2/99	1755 - 2010	10/3/99	0930 - 1530	21:35	24 35.7'	168 04.9'	24 26.8'	168 00.6'	10.4	32.2	450
13	10/3/99	1805 - 1900	10/4/99	1055 - 1230	16:25	24 25.8'	168 00.1'	24 24.6'	167 55.7'	4.4	33.4	210
14	10/4/99	1735 - 1930	10/5/99	0845 - 1515	21:40	24 34.0'	167 51.9'	24 44.0'	167 53.5'	10.3	36.9	450
15	10/5/99	1800 - 1925	10/6/99	0855 - 1245	18:45	24 32.7'	167 51.9'	24 25.2'	167 54.7'	8.1	36.5	360
St. Rogatien Bank												
16	10/6/99	1920 - 2100	10/7/99	1010 - 1830	23:10	24 26.0'	167 08.7'	24 21.5'	167 03.4'	8.0	36.6	390
17	10/7/99	1930 - 2125	10/8/99	0940 - 1730	22:00	24 25.0'	167 11.0'	24 17.5'	167 12.1'	8.5	36.3	390
French Frigate Shoals												
18	10/9/99	1855 - 2100	10/10/99	0935 - 1500	20:05	23 44.2'	166 22.8'	23 39.1'	166 16.2'	8.1	34.5	420
19	10/10/99	1735 - 1920	10/11/99	0910 - 1235	19:00	23 53.3'	166 17.0'	23 48.8'	166 23.2'	8.4	35.5	420
Nihoa West-1												
20	10/12/99	2010 - 2130	10/13/99	0900 - 1250	16:40	23 14.3'	162 59.3'	23 13.5'	162 54.8'	7.8	41.1	390
Nihoa West-2												
21	10/13/99	2000 - 2205	10/14/99	0845 - 1415	18:15	23 03.2'	162 17.7'	23 01.0'	162 07.8'	9.5	38.8	420

Shark Catch

Five species of sharks were caught during the trip (see Appendix 6 for photographs).[3] The vessel specifically targeted sandbar sharks (*Carcharhinus plumbeus*), Galapagos sharks (*C. galapagensis*), and tiger sharks (*Galeocerdo cuvier*). Grey reef sharks (*C. amblyrhynchos*) and blacktip sharks (*C. limbatus*) were also caught. Sandbar sharks accounted for the majority of the catch (69% by number). Catches by species and area are shown in Tables 2 and 3, respectively.

Table 2. Number of sharks caught and catch per unit effort, by species.

Species	Total number caught		Catch per unit effort	
	NWHI	MHI	number per set	number per 100 hooks
Sandbar shark	685	12	33	8.8
Galapagos shark	182	4	9	2.3
Tiger shark	95	6	5	1.3
Grey reef shark	20	0	1	0.3
Blacktip shark	8	1	< 1	0.1
All species	**990**	**23**	**48**	**12.7**

Table 3. Number of sharks caught and catch per unit effort, by area.

Area	Total number caught	Catch per unit effort	
		number per set	number per 100 hooks
Necker Island (NWHI)	13	13	3.2
Gardner Pinnacles (NWHI)	684	53	14.6
St. Rogatien Bank (NWHI)	162	81	20.8
French Frigate Shoals (NWHI)	64	32	7.6
Nihoa West-1 (NWHI)	24	24	6.2
Nihoa West-2 (NWHI)	43	43	10.2
NWHI subtotal	**990**	**50**	**13.1**
Penguin Bank (MHI)	23	23	5.5
All areas	**1,013**	**48**	**12.7**

The vessel did not target specific ages or sizes of sharks. Captured sharks ranged from approximately 3 feet in length to greater than 13 feet (Table 4). Individual shark lengths and sexes are provided in Appendix 1.

[3] The terms "captured" and "caught" as used in this report include fish that were observed on the line but lost prior to being brought aboard.

Table 4. Lengths of sharks, by species.

Species	Range of lengths (TL)		Average length (TL)	
	cm	ft	cm	ft
Sandbar shark	109 – 185	3.6 – 6.1	152	5.0
Galapagos shark	85 – 279	2.8 – 9.2	203	6.7
Tiger shark	78 – 410	2.6 – 13.5	257	8.4
Grey reef shark	112 – 159	3.7 – 5.2	148	4.9
Blacktip shark	184 – 213	6.0 – 7.0	191	6.3

Fourteen sandbar, Galapagos, and tiger sharks were weighed before and after processing to determine product recovery weights (Table 5). All the weighed sandbar and Galapagos sharks were processed into tubes. The single weighed tiger shark was processed into skin-off loins. Recovery weights for processed sharks averaged 56 percent for sandbar sharks, 50 percent for Galapagos sharks, and 28 percent for the single tiger shark. Recovery weights for grey reef and blacktip sharks were not obtained.[4]

Table 5. Shark recovery weights and percentages.

Species	Product type	Number of sharks	Length (TL, cm)	Round weight (lb)	Processed weight (lb)	Proportion recovered (%)
Sandbar shark	tubes	3	140 – 155	175	105	60
		2	138 – 152	130	55	42
		1	157	100	55	55
		1	173	115	75	65
		Total		**520**	**290**	**56**
Galapagos shark	tubes	1	202	150	75	50
		1	242	260	125	48
		1	251	275	150	55
		1	214	200	105	52
		1	233	260	125	48
		1	265	340	160	47
		Total		**1,485**	**740**	**50**
Tiger shark	loins	1	405	1,250	350	28
		Total		**1,250**	**350**	**28**

Of the 1,013 captured sharks, 88 percent was retained, 8 percent was discarded due to damage from predation by sharks (but a few sharks that had been damaged were retained), 3 percent was lost before being brought aboard, and 1 percent was released alive (Table 6). A shark was recorded as "lost" if it was seen coming up on the line by the captain, crew, or observer but it got off the line before being boated. Most of the intentionally released sharks

[4] The vessel captain indicated that his typical yield for tubes was about 60 percent of round weight and his typical yield for skin-off loins was about 60 percent of tube weight, or about 36 percent of round weight (J. Cross, pers. comm.).

were tiger sharks that were not retained because of their small size. The hooks were removed prior to the sharks being released. About two-thirds of the released sharks were tagged by the observer (see Appendix 2). Five tiger shark pups that were recovered from pregnant females were also tagged and released.

Table 6. Disposition of captured sharks.

Species	Total number caught	Disposition				
		Retained	Discarded damaged	Lost	Released alive, tag	Released alive, no tag
Sandbar shark	697	643	45	8	1	0
Galapagos shark	186	155	26	5	0	0
Tiger shark	101	69	3	16	* 9	4
Grey reef shark	20	16	4	0	0	0
Blacktip shark	9	9	0	0	0	0
All species	**1,013**	**892**	**78**	**29**	**10**	**4**

* An additional five tiger shark pups that were recovered from pregnant females were tagged and released.

The proportion of sharks that was alive upon being boated varied considerably among species. Tiger sharks had the highest percentage alive, at 84 percent. The proportion of sandbar sharks boated alive was 52 percent, and the proportions for the other three species were all less than 25 percent (Table 7).

Table 7. Condition of sharks upon capture.

Species	Number alive	Number dead	Percent alive
Sandbar shark	361	328	52
Galapagos shark	16	165	9
Tiger shark	71	14	84
Grey reef shark	2	18	10
Blacktip shark	2	7	22
All species	**452**	**532**	**46**

Sharks that were lost before being boated are not accounted for here – all of them were alive.

Incidental Catch

A total of 60 pieces of non-shark species were incidentally captured during the trip, of which 32 were finfish and 28 were invertebrates (Table 8). The predominant finfish species were uku (*Aprion virescens*) and a few species of trevally (Carangidae). The predominant invertebrate was the sea star (*Luidia magnifica*), which actively competed for the bait. Of six pieces of coral that were hooked, only one, a piece of rose coral (*Pocillopora* sp.), could be identified. The others were flat pieces of coral.

All non-shark species that were captured were discarded, with the exception of spotted eagle rays and moray eels, all of which (5 pieces total) were kept for use as bait, and one trevally that was lost before being boated. About half of the finfish were damaged by predation. Most of

the remainder were alive upon being boated. Of the 28 invertebrates, all were landed alive but one, a piece of unidentified coral. See Appendix 1 for further details.

Table 8. Incidental catch.

Species	Total number caught	Disposition		
		Retained	Discarded	Lost
Uku (*Aprion virescens*)	13	0	13	0
Trevallies (Carangidae)	9	0	8	1
Spotted eagle ray (*Aetobatis narinari*)	3	3	0	0
Kahala (*Seriola dumerili*)	2	0	2	0
Moray eel (*Gymnothorax flavimarginatus*)	2	2	0	0
Kokala (*Diodon hystrix*)	1	0	1	0
Hapu'upu'u (*Epinephelus quernus*)	1	0	1	0
Opakapaka (*Pristipomoides filamentosus*)	1	0	1	0
Sea star (*Luidia magnifica*)	15	0	15	0
Coral, unidentified	6	0	6	0
Bryozoan on rock	2	0	2	0
Kona crab (*Ranina ranina*)	2	0	2	0
Box crab (*Calappa calappa*)	1	0	1	0
Macroalgae and rock	1	0	1	0
Rose coral (*Pocillopora* sp.)	1	0	1	0
All species	**60**	**5**	**54**	**1**

Shark Stomach Contents

The shark stomachs contained eels, sharks, other finfish, sea turtles, octopus, lobster, shrimp, crab, whale vertebrae, worms, coral, birds, garbage, and pieces of nets. A list of the items found during the on-deck observations (in which the stomachs of 95% of captured sharks were examined), by area and species, is given in Table 9. A list of the items found in the 11 tiger shark stomachs that were examined in the laboratory after the trip is given in Table 10.

Table 9. Shark stomach contents, by area and species.

Necker Island, Set 1

Tiger:	1 unidentified bird, 1 whale bone (vertebra)
Sandbar:	1 octopus, 1 porcupinefish, 2 empty stomachs
Galapagos:	2 octopi, 4 empty stomachs

Penguin Bank, Set 2

Sandbar:	1 ulua
Galapagos:	1 octopus, 1 unidentified fish, 1 ulua
Tiger:	2 green turtles, 1 unidentified bird, 2 racing homing pigeons, 20 octopi, 1 shark, 2 Kona crabs, 1 filefish
Blacktip:	1 unidentified bird

Gardner Pinnacles, Set 3 - 15

Sandbar:	119 octopi, 2 sharks, 25 unidentified fish, 1 opakapaka, 2 uku, 4 squid, 5 moray eels, 4 unidentified eels, 1 cusk eel, 1 lantern fish, 1 needlefish, 1 triggerfish, 1 butterflyfish, 1 ulua, 8 porcupinefish, 3 jacks, 5 mantis shrimp, 2 Kona crabs, 6 lobsters, 13 medusa worms, 8 offal, 2 pieces bait, 6 pieces coral rock
Galapagos:	54 octopi, 3 sharks, 9 fish, 2 uku, 2 opakapaka, 1 porcupinefish, 1 cowfish, 1 moray eel, 2 mantis shrimp, 1 lobster, 1 medusa worm, 12 offal, 6 pieces coral rock, 6 empty stomachs
Tiger:	5 loggerhead turtles, 1 green turtle, 3 unidentified birds, 29 octopi, 9 sharks (including one tiger shark tagged two days previously, tag no. HL 1230), 69 unidentified fish, 2 ulua, 3 trumpetfish, 11 porcupinefish, 1 jack, 3 Kona crabs, 8 lobsters, 7 offal, 2 pieces net, 1 piece coral rock, 11 pieces garbage, 2 empty stomachs
Grey reef:	1 octopus, 1 unidentified fish, 3 stomachs with gruel, 7 empty stomachs
Blacktip:	1 unidentified fish, 1 stomach with gruel, 5 empty stomachs

St. Rogatien Bank, Set 16 - 17

Sandbar:	38 octopi, 21 unidentified fish, 1ulua, 1 porcupinefish, 1 trunkfish, 2 triggerfish, 2 moray eels, 4 medusa worms, 1 Kona crab, 1 lobster, 16 offal, 1 bait, 2 coral rocks, 48 empty stomachs
Galapagos:	4 octopi, 1 shark, 2 unidentified fish, 1 porcupinefish, 1 triggerfish, 2 offal, 6 empty stomachs
Tiger:	3 loggerhead turtles, 3 green turtles, 3 unidentified birds, 7 octopus, 4 sharks, 3 unidentified fish,2 ulua, 3 porcupinefish, 2 lobsters, 1 offal, 1 piece garbage, 1 empty stomach
Grey reef:	2 empty stomachs

French Frigate Shoals, Set 18 - 19

Sandbar:	13 octopi, 1 shark, 10 unidentified fish, 1 trunkfish, 2 cowfish, 6 unidentified eel, 1 lobster, 1 shrimp, 1 medusa worm, 4 pieces bait, 3 pieces coral rocks, 20 empty stomachs
Galapagos:	3 octopi, 1 shark, 6 empty stomachs
Tiger:	1 turtle, 2 octopi, 1 shark, 1 unidentified fish, 1 lobster, 1 piece net, 1 piece garbage
Grey reef:	1 empty stomach

Nihoa West-1, Set 20

Sandbar:	1 octopus, 7 unidentified fish, 1 cowfish, 1 filefish, 3 unidentified eel, 4 pieces coral rock, 2 empty stomachs
Galapagos:	1 flyingfish, 2 empty stomachs
Tiger:	1 bird, 1 octopus, 3 sharks, 1 unidentified fish, 1 porcupinefish, 1 lobster, 1 empty stomach
Grey reef:	2 empty stomachs

Nihoa West-2, Set 21

Sandbar:	6 octopi, 5 fish, 3 porcupinefish, 1 butterflyfish, 1 moray eel, 1 unidentified eel, 1 piece bait, 1 piece coral rock, 19 empty stomachs
Galapagos:	2 octopi, 2 sharks, 2 uku, 1 unidentified eel, 1 piece coral rock
Tiger:	2 birds, 1 octopus, 1 unidentified fish, 3 porcupinefish

Table 10. Stomach contents of selected tiger sharks.

Sample 1, Necker Island, Set 1

Stomach had 4 octopi beaks, 1 digested bird part (tropic bird or tern), piece of net (green, 11" mesh, 32 x 42 cm)

Sample 2, Necker Island, Set 1

Stomach had unidentified bird feathers, 15 x 20 cm bone, possibly a whale vertebra

Sample 3, Penguin Bank, Set 2

Stomach had 1 octopus beak, 1 transmitter #2308 (pinger type), shark tagged but no identifiable numbers

Sample 4, Penguin Bank, Set 2

Stomach had remains of 1 green turtle, turtle tags #N-844 and N-845, bird feathers, bird tag #0822 IF99 AIEA (yellow plastic band) racing homing pigeon, 1 small piece of liver (uncertain), 3 strands of human hair

Sample 5, Penguin Bank, Set 2

Stomach had remains of 1 green turtle with a partial number painted on carapace (A-1166), 3 turtle eggs, remains of Kona crab, unidentified bird feathers, 1 small shark possibly Galapagos

Sample 6, Penguin Bank, Set 2

Stomach had 14 octopus beaks, 1 part digested filefish, remains of 1 Kona crab, bird feathers, bird skin (uncertain), 2 bird bands recovered (1 plastic yellow tag #0543 IF99 Honolulu and 1 yellow rubber band tag #7813 – both from the same racing carrier pigeon)

Sample 7, Gardener Pinnacles, Set 9

Stomach had 6 turtle beaks (5 loggerheads and 1 green), remains of turtle scutes, jaw of porcupine fish, 1 large octopus, 4 octopi beaks, piece of plastic garbage bag, piece of plastic, piece of plastic tie, remains of bird(s), feathers

Sample 8, Gardener Pinnacles, Set 11

Stomach had turtle shell and scute remains, feathers, remains of Kona crab, sea fan branches, 1 5-gallon bucket, pieces of plastic, 1 lighter, 16 octopi beaks, fishing leader, pieces of hose, pieces of garbage bag, 2 types of nets (one green, 4" mesh, 8 x 15 cm), vertebrae unidentified

Sample 9, St. Rogatien Bank, Set 16

Stomach had 6 turtle beaks, turtle scutes and shell remains (3 loggerheads and 3 greens), 5 octopus beaks, bird feathers, pieces of plastic, piece of line

Sample 10, French Frigate Shoals, Set 18

Stomach had remains of slipper lobster, 1 set of turtle beaks and turtle remains, vertebrae of unidentified fish, tail of eaten shark, 2 octopus beaks, piece of net (11" mesh, 158 x 366 cm), small pieces of plastic

Sample 11, Nihoa West-1, Set 20

Stomach had 1 digested porcupinefish, 1 digested fish, 1 piece unidentified bone

The remains of 17 turtles were found in the stomachs of sharks caught on the trip. Some stomachs contained more than one turtle. Stomach Sample 7, taken from a tiger shark caught at Gardner Pinnacles, contained six sets of turtle beaks, five from loggerhead sea turtles (*Caretta caretta*) and one from a juvenile green sea turtle (*Chelonia mydas*) (G. Balazs, Honolulu Lab, pers. comm.). Stomach Sample 9, collected from a tiger shark caught at St. Rogatien Bank, contained three loggerhead and three green sea turtles (G. Balazs, pers. comm.).

The stomachs of tiger sharks caught during Set 2 (Penguin Bank) contained some interesting items. Two identifiable metal flipper tags were recovered from the stomach of one tiger shark (Sample 4). The tags were from a green sea turtle tagged and released off Waikiki beach in 1991. Its size at the time of release was 42 cm (curved length) (G. Balazs, pers. comm.). A section of green sea turtle carapace displaying a painted number was collected from another tiger shark (Sample 5). This turtle was apparently only recently consumed by the tiger shark, as most of the shell was intact, with meat and flesh still attached. The presence of three eggshells in the tiger shark's stomach suggests that the turtle may have been eaten shortly after laying eggs and returning to the ocean. This turtle was tagged in June 1999 while nesting on East Island, French Frigate Shoals (G. Balazs, pers. comm.). At the time of tagging the turtle measured 90.5 cm. The tiger shark was caught approximately 520 nm from where the turtle was tagged.

The stomachs of several tiger sharks contained the remains of birds. Most of these birds were possibly shearwaters or petrels. Three bird bands were recovered from the stomachs of two tiger sharks caught on Set 2. It was determined that the bands came from a species of rock dove or carrier pigeon. There are several pigeon clubs that breed and race these birds around the MHI (K. Swift, U.S. Fish and Wildlife Service, Honolulu, pers. comm.). There are no other records of such birds being eaten by sharks.

A tiger shark caught during Set 2 contained the above mentioned sea turtle and bird tags as well as several strands of hair. Tests conducted by the Detective Division of the Maui police department determined that it was human hair. An investigation is continuing at the time of this report but there is no match with recent shark attack victims.

A small tiger shark (144 cm TL) that was caught on Set 5 and subsequently tagged and released (tag no. HL 1230) was found in the stomach of another, larger tiger shark (345 cm TL), caught two days later on Set 7. The tagged shark was partially digested, with most of the skin dissolved and the head completely digested with only the jaw remaining. The tagged shark had a hook protruding from its jaw and 3 cm of gangion line remaining. The hook and gangion were undoubtedly gear from the *Anna C.* The small tiger shark had been a bit sluggish and stressed when it was released, but it did swim away along the surface for quite a distance thereafter. Apparently the tagged shark returned to the gear, which was set in a different area off Gardner Pinnacles, and became hooked a second time. The tagged tiger shark was then apparently preyed upon by the larger tiger shark.

Set 2 also resulted in the capture of a tiger shark that was tagged with a capsule type tag and implanted with a transmitter. The shark was tagged just below the dorsal fin on its left side, but only the anchor and a small portion of the tag remained. The transmitter was a pinger-type data logger, which collected information on depth and the shark's movements. The tiger shark was a female tagged and released off Sand Island, Oahu, on June 25, 1996. Information from this and previously recovered transmitters have shown a pattern of tiger shark movements from Oahu to Penguin Bank (K. Holland, Hawaii Institute of Marine Biology, pers. comm.). Interestingly, the transmitter was recorded as having been surgically implanted into the shark's abdomen, but on recovery it was found surrounded by the stomach wall inside the shark. Sex information and

length measurements taken at the time the shark was tagged were consistent with the sex and length measurements obtained on this trip when the shark was captured. This indicates that the transmitter belonged to the shark that was tagged, not to a shark that was eaten.

Sex and Reproductive Condition of Sharks

Of the 905 sharks whose sex could be identified, 48 percent were female. The female-to-male sex ratio for sandbar, Galapagos, and tiger sharks was close to one. It was substantially less than one for grey reef and blacktip sharks, as indicated in Table 11. Further details by set are provided in Appendix 1.

Of the 432 female sharks, 50 were found to be pregnant, including 30 sandbar sharks, 11 Galapagos sharks, eight tiger sharks, and one grey reef shark. Pup and embryo counts were made on all pregnant sharks. The majority of embryos (79%) were dead upon capture. The number of embryos per shark ranged from 2 to 44. Embryo size ranged from 3 to 24 cm (total stretch length). Fifty-five percent of pups were alive upon capture, although 78 percent of the live pups came from just three tiger sharks. Pup size ranged from 14 to 85 cm (total stretch length) and litter size ranged from 3 to 42 individuals. Tiger sharks had generally larger embryos, pups, and litter sizes than the other species. Further details are provided in Appendix 5.

Table 11. Sex and reproductive condition of sharks.

Species	Number female	Number male	Percent female	Percent of females pregnant
Sandbar shark	290	354	45	10
Galapagos shark	86	69	55	13
Tiger shark	53	28	65	15
Grey reef shark	2	14	12	50
Blacktip shark	1	8	11	0
All species	**432**	**473**	**48**	**12**

Interactions with Protected Species

No interactions with birds, sea turtles, or marine mammals were observed during setting or hauling of the gear. On two occasions when the vessel was not fishing, a Hawaiian monk seal was observed near the vessel. The sightings occurred during the early evening, while the vessel was anchored in shallow water inside the middle area of Gardner Pinnacles.

AUTHOR'S AFTERWORD

This study describes bottom longline fishing for nearshore sharks in the NWHI and MHI. However, it provides only cursory information on Hawai'i's shark populations and their sustainable yields. If fishing for nearshore sharks continues in the NWHI and MHI, an observer/biologist should be required on board each vessel[5]. This requirement would allow further morphometric and meristic information to be gathered and catch and effort estimates to be made and would provide information normally not available to programs such as the shark tagging and turtle research programs. Although there were no observations of interactions with Hawaiian monk seals while fishing during this trip, the potential for hooking still exists. Until further assessments can be made to determine the impacts bottom longline gear could have on shark populations in the NWHI and MHI, a precautionary management approach is recommended.

This report would not have been possible without the help of a host of people from both the fishing and scientific communities. I would like to thank Capt. Junior Cross and his crew aboard the F/V *Anna C*, who extended the invitation and their assistance while at sea. I am particularly grateful to Alvin Katekaru (PIRO), who helped oversee the entire project and provided the necessary resources to complete the work. I also would like to thank the staff of the Honolulu Lab, Protected Species Investigation, Bud Antonelis and Jason Baker, for their information and assistance on Hawaiian monk seals, and George Balazs for the post-trip analysis of the turtle samples collected. In addition I am grateful to John Naughton, shark biologist with PIRO, and Arnold Suzimoto of the Bishop Museum for the information on shark identification. Bird tagging information was obtained from Katie Swift and Beth Flint of the U.S. Fish and Wildlife Service. The comments received on the draft report from Charles Karnella, Marcia Hamilton, Ray Clarke, and John Naughton (PIRO), Sylvia Spalding (Western Pacific Regional Fishery Management Council), and Tom Kazama (Honolulu Lab) are much appreciated. Finally, I would like to acknowledge Lewis Van Fossen, Kevin Busscher, and Joe Arceneaux at the PIRO Hawaii Longline Observer Program for their help in providing all the necessary equipment, data forms, and logistical support.

[5] Recommendation is that of the author and does not necessarily represent the position of NOAA Fisheries.

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Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
1	Sandbar	M	136	113	54			Y					
1	Sandbar	M	165	138	68			Y					
1	Sandbar	M	165	138	65			Y					
1	Sandbar	F	174	153	81			Y					
1	Galapagos	F	139	119	47			Y					
1	Galapagos	F	156	133	53			Y					
1	Galapagos	M	189	157	65			Y					
1	Galapagos	M	191	165	66			Y					
1	Galapagos	F	225	184	76			Y					
1	Tiger	F	124	106	51							Y	
1	Tiger	M	354	325	158			Y					
1	Tiger						Y						
1	Tiger						Y						
1	Sea star									Y			
1	Sea star									Y			
1	Sea star									Y			
1	Sea star									Y			
1	Uku									Y			

Set 1 summary (Necker Island)

No.		% F	Ave.	Ave.	Ave.	Ave.	No.	No.	No.	No.	No.	No.	No.
4	**Sandbar**	**25**	**160**	**136**	**67**		**0**	**4**	**0**	**0**	**0**	**0**	**0**
5	**Galapagos**	**60**	**180**	**152**	**61**		**0**	**5**	**0**	**0**	**0**	**0**	**0**
4	**Tiger**	**50**	**239**	**216**	**105**		**2**	**1**	**0**	**0**	**0**	**1**	**0**
0	**Grey reef**												
0	**Blacktip**												
13	**SHARKS TOTAL**						**2**	**10**	**0**	**0**	**0**	**1**	**0**
5	**Non-sharks**						**0**	**0**	**0**	**5**	**0**	**0**	**0**
2	Sandbar	M	114	98	45	4		Y					
2	Sandbar	F	124	108	50			Y					
2	Sandbar	F	142	118	54			Y					
2	Sandbar	M	153	129	58	13		Y					
2	Sandbar	F	155	130	60			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
2	Sandbar	F	167	141	66			Y					
2	Sandbar	F	168	147	68			Y					
2	Sandbar	F	169	143	66			Y					
2	Sandbar	F	172	148	70			Y					
2	Sandbar										Y		
2	Sandbar										Y		
2	Sandbar										Y		
2	Galapagos	M	121	106	49	4		Y					
2	Galapagos	M	255	211	89	19		Y					
2	Galapagos	F	271	221	93			Y					
2	Galapagos										Y		
2	Tiger	F	354	303	129			Y					
2	Tiger	M	356	295	125	26		Y					
2	Tiger	M	360	313	134	23		Y					
2	Tiger	F	360	320	136			Y					
2	Tiger	F	367	337	144			Y					
2	Tiger	F	403	343	147			Y					
2	Blacktip	M	192	163	69	13		Y					
2	Spotted eagle ray							Y					
2	Coral, unidentified									Y			
2	Rose coral									Y			
2	Trevally									Y			
2	Trevally										Y		
Set 2 summary (Penguin Bank)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
12	**Sandbar**	**78**	**152**	**129**	**60**	**9**	**0**	**9**	**0**	**0**	**3**	**0**	**0**
4	**Galapagos**	**33**	**216**	**179**	**77**	**12**	**0**	**3**	**0**	**0**	**1**	**0**	**0**
6	**Tiger**	**67**	**367**	**319**	**136**	**25**	**0**	**6**	**0**	**0**	**0**	**0**	**0**
0	**Grey reef**												
1	**Blacktip**	**0**	**192**	**163**	**69**	**13**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
23	**SHARKS TOTAL**						**0**	**19**	**0**	**0**	**4**	**0**	**0**
5	**Non-sharks**						**0**	**1**	**0**	**3**	**1**	**0**	**0**

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
3	Sandbar	F	134	116	53			Y					
3	Sandbar	M	138	122	55	11		Y					
3	Sandbar	F	138	120	54			Y					
3	Sandbar	F	143	119	55			Y					
3	Sandbar	M	144	123	55	10		Y					
3	Sandbar	F	145	124	58			Y					
3	Sandbar	M	147	129	60	13		Y					
3	Sandbar	F	148	127	58			Y					
3	Sandbar	M	151	132	62	13		Y					
3	Sandbar	M	152	131	59	12		Y					
3	Sandbar	M	152	133	63	13		Y					
3	Sandbar	M	153	129	57	13		Y					
3	Sandbar	F	153	132	61			Y					
3	Sandbar	M	155	130	59	14		Y					
3	Sandbar	M	156	136	63	13		Y					
3	Sandbar	M	157	140	64	13		Y					
3	Sandbar	M	158	134	62	13		Y					
3	Sandbar	F	162	143	67			Y					
3	Sandbar	F	163	142	69			Y					
3	Sandbar	F	165	146	67			Y					
3	Sandbar	F	166	148	71			Y					
3	Sandbar	F	168	150	73			Y					
3	Sandbar	F	169	147	68			Y					
3	Sandbar	F	175	151	70			Y					
3	Sandbar	F	175	152	71			Y					
3	Sandbar	F	180	151	71			Y					
3	Sandbar	F	182	152	75			Y					
3	Sandbar	M			64	12		Y					
3	Sandbar	M									Y		
3	Sandbar										Y		
3	Sandbar										Y		
3	Sandbar										Y		
3	Galapagos	F	158	135	56			Y					
3	Galapagos	F	186	165	68			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
3	Galapagos	F	201	169	69			Y					
3	Galapagos	F	218	184	77			Y					
3	Galapagos	F	227	193	81			Y					
3	Galapagos	F	230	200	83			Y					
3	Galapagos	F	233	179	76			Y					
3	Galapagos	F	242	210	86			Y					
3	Galapagos		245	213	83				Y				
3	Galapagos	F	246	213	87			Y					
3	Galapagos	F	272	225	95				Y				
3	Galapagos	F									Y		
3	Galapagos										Y		
3	Galapagos										Y		
3	Galapagos										Y		
3	Galapagos										Y		
3	Tiger	F	260	240	102			Y					
3	Tiger	F	260	224	97			Y					
3	Blacktip	M	184	161	67	13		Y					
3	Blacktip	M	189	159	67	13		Y					
3	Sea star									Y			
Set 3 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
32	**Sandbar**	**55**	**157**	**136**	**63**	**13**	**0**	**28**	**0**	**0**	**4**	**0**	**0**
16	**Galapagos**	**100**	**223**	**190**	**78**		**0**	**9**	**2**	**0**	**5**	**0**	**0**
2	**Tiger**	**100**	**260**	**232**	**100**		**0**	**2**	**0**	**0**	**0**	**0**	**0**
0	**Grey reef**												
2	**Blacktip**	**0**	**187**	**160**	**67**	**13**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
52	**SHARKS TOTAL**						**0**	**41**	**2**	**0**	**9**	**0**	**0**
1	**Non-sharks**						**0**	**0**	**0**	**1**	**0**	**0**	**0**
4	Sandbar	F	109	93	41						Y		
4	Sandbar	M	129	112	51	4		Y					
4	Sandbar	M	136	120	53	10		Y					
4	Sandbar	M	138	120	54	8		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
4	Sandbar	F	138	118	54			Y					
4	Sandbar	F	140	119	55			Y					
4	Sandbar	M	141	123	56	12		Y					
4	Sandbar	F	142	122	54			Y					
4	Sandbar	F	142	123	58			Y					
4	Sandbar	M	145	127	58	12		Y					
4	Sandbar	M	147	127	58	11		Y					
4	Sandbar	M	149	130	61	13		Y					
4	Sandbar	M	149	128	60	12		Y					
4	Sandbar	M	150	129	57	13		Y					
4	Sandbar	M	150	131	60	13		Y					
4	Sandbar	M	153	132	60	13		Y					
4	Sandbar	M	155	133	60	12		Y					
4	Sandbar	M	155	131	61	11		Y					
4	Sandbar	M	155	134	62	13		Y					
4	Sandbar	F	155	132	59			Y					
4	Sandbar	M	157	136	61	12		Y					
4	Sandbar	M	158	135	63	13		Y					
4	Sandbar	M	160	139	66	13		Y					
4	Sandbar	M	160	135	62	13		Y					
4	Sandbar	M	162	143	64	12		Y					
4	Sandbar	M	163	139	65	13		Y					
4	Sandbar	M	163	139	64	13		Y					
4	Sandbar	F	163	140	64			Y					
4	Sandbar	F	167	144	67			Y					
4	Sandbar	F	171	147	69			Y					
4	Sandbar	F	177	153	71			Y					
4	Sandbar	F	180	156	72			Y					
4	Sandbar	F	180	157	71			Y					
4	Sandbar										Y		
4	Sandbar										Y		
4	Sandbar										Y		
4	Sandbar										Y		
4	Galapagos	M	187	160	67	6		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
4	Galapagos	F	188	162	65			Y					
4	Galapagos	M	194	166	68	7		Y					
4	Galapagos	M	205	172	71	12		Y					
4	Galapagos	M	220	186	76	18		Y					
4	Galapagos	M	222	184	77	18		Y					
4	Galapagos	M	225	186	79	17		Y					
4	Galapagos	M	245	207	89	13		Y					
4	Galapagos	F	250	217	87			Y					
4	Galapagos	F	263	231	95			Y					
4	Tiger	F	78	65								Y	
4	Tiger		115	99									Y
4	Tiger	F	198	162	65			Y					
4	Tiger	M	235	193	82	8		Y					
4	Tiger	F	249	190	78			Y					
4	Tiger	M	305	264	116	20		Y					
4	Tiger	F	340	302	131			Y					
4	Tiger	F	340	340	144			Y					
4	Tiger	F	366	326	139			Y					
4	Kona crab	M								Y			
Set 4 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
37	**Sandbar**	**36**	**153**	**132**	**60**	**12**	**0**	**32**	**0**	**0**	**5**	**0**	**0**
10	**Galapagos**	**30**	**220**	**187**	**77**	**13**	**0**	**10**	**0**	**0**	**0**	**0**	**0**
9	**Tiger**	**75**	**247**	**216**	**108**	**14**	**0**	**7**	**0**	**0**	**0**	**1**	**1**
0	**Grey reef**												
0	**Blacktip**												
56	**SHARKS TOTAL**						**0**	**49**	**0**	**0**	**5**	**1**	**1**
1	**Non-sharks**						**0**	**0**	**0**	**1**	**0**	**0**	**0**
5	Sandbar	F	127	145	60			Y					
5	Sandbar	F	128	110	50			Y					
5	Sandbar	F	132	116	53			Y					
5	Sandbar	M	133	117	51	5		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
5	Sandbar	F	133	115	50			Y					
5	Sandbar	F	141	122	56			Y					
5	Sandbar	F	141	124	56			Y					
5	Sandbar	M	142	123	56	5		Y					
5	Sandbar	F	142	121	56			Y					
5	Sandbar	F	144	125	57			Y					
5	Sandbar	M	147	128	57	11		Y					
5	Sandbar	M	147	126	58	11		Y					
5	Sandbar	M	147	128	60	11		Y					
5	Sandbar	F	148	130	60			Y					
5	Sandbar	F	148	130	58			Y					
5	Sandbar	F	148	129	59			Y					
5	Sandbar	F	150	132	60			Y					
5	Sandbar	F	150	128	58			Y					
5	Sandbar	M	151	132	60	12		Y					
5	Sandbar	M	152	130	61	12		Y					
5	Sandbar	M	152	131	60	12		Y					
5	Sandbar	F	152	132	61			Y					
5	Sandbar	M	153	134	60	12		Y					
5	Sandbar	F	153	131	60			Y					
5	Sandbar	F	153	134	63			Y					
5	Sandbar	F	154	132	61			Y					
5	Sandbar	M	155	136	61	13		Y					
5	Sandbar	F	155	134	63			Y					
5	Sandbar	M	156	132	60	13		Y					
5	Sandbar	M	156	138	63	13		Y					
5	Sandbar	M	157	139	62	13		Y					
5	Sandbar	M	157	138	61	13		Y					
5	Sandbar	M	157	136	61	12		Y					
5	Sandbar	M	157	138	62	12		Y					
5	Sandbar	F	157	138	65			Y					
5	Sandbar	F	157	136	63			Y					
5	Sandbar	M	158	139	63	13		Y					
5	Sandbar	M	158	136	62	11		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
5	Sandbar	F	158	137	61			Y					
5	Sandbar	M	159	136	63	13		Y					
5	Sandbar	M	160	139	2	13		Y					
5	Sandbar	M	160	138	62	13		Y					
5	Sandbar	F	161	141	64			Y					
5	Sandbar	F	162	141	64			Y					
5	Sandbar	M	163	140	63	12		Y					
5	Sandbar	F	164	141	65			Y					
5	Sandbar	F	164	142	63			Y					
5	Sandbar	F	165	139	65			Y					
5	Sandbar	F	166	145	68			Y					
5	Sandbar	F	167	146	68			Y					
5	Sandbar	F	167	146	67			Y					
5	Sandbar	F	168	146	65			Y					
5	Sandbar	F	169	147	68			Y					
5	Sandbar	F	169	146	69			Y					
5	Sandbar	F	169	145	67			Y					
5	Sandbar	F	170	148	68			Y					
5	Sandbar	F	170	148	68			Y					
5	Sandbar	F	170	151	72			Y					
5	Sandbar	F	171	147	69			Y					
5	Sandbar	F	172	151	71			Y					
5	Sandbar	F	173	152	71			Y					
5	Sandbar	F	178	152	70			Y					
5	Sandbar	F	183	154	73			Y					
5	Sandbar	F	185	159	73			Y					
5	Sandbar					12			Y				
5	Sandbar										Y		
5	Sandbar										Y		
5	Sandbar										Y		
5	Galapagos	M	103	89	36	2		Y					
5	Galapagos	F	156	133	54			Y					
5	Galapagos	M	181	156	63	4		Y					
5	Galapagos	M	184	159	65	6		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
5	Galapagos	M	185	159	65	4		Y					
5	Galapagos	F	200	172	70			Y					
5	Galapagos	F	227	190	78			Y					
5	Galapagos	F	230	196	81			Y					
5	Galapagos	F	236	198	80			Y					
5	Galapagos	F	249	214	89			Y					
5	Galapagos	F	256	221	91			Y					
5	Galapagos	F	279	216	89			Y					
5	Galapagos										Y		
5	Galapagos										Y		
5	Tiger	M	144	120	50	3							Y
5	Tiger	F	336	320	135			Y					
5	Tiger						Y						
5	Tiger						Y						
5	Tiger										Y		
5	Grey reef	M	152	135	52	12		Y					
5	Grey reef										Y		
5	Blacktip	M	193	166	70	14		Y					
5	Bryozoan on rock									Y			
5	Bryozoan on rock									Y			
5	Kahala										Y		
5	Opakapaka										Y		
5	Trevally										Y		
Set 5 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
68	**Sandbar**	**66**	**156**	**136**	**61**	**12**	**0**	**64**	**1**	**0**	**3**	**0**	**0**
14	**Galapagos**	**67**	**207**	**175**	**72**	**4**	**0**	**12**	**0**	**0**	**2**	**0**	**0**
5	**Tiger**	**50**	**240**	**220**	**93**	**3**	**2**	**1**	**0**	**0**	**1**	**0**	**1**
2	**Grey reef**	**0**	**152**	**135**	**52**	**12**	**0**	**1**	**0**	**0**	**1**	**0**	**0**
1	**Blacktip**	**0**	**193**	**166**	**70**	**14**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
90	**SHARKS TOTAL**						**2**	**79**	**1**	**0**	**7**	**0**	**1**
5	**Non-sharks**						**0**	**0**	**0**	**2**	**3**	**0**	**0**

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
6	Tiger	F	130	113	47			Y					
6	Tiger	F	155	125	50			Y					
6	Tiger	F	354	316	132			Y					
Set 6 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
0	**Sandbar**												
0	**Galapagos**												
3	**Tiger**	**100**	**213**	**185**	**76**		**0**	**3**	**0**	**0**	**0**	**0**	**0**
0	**Grey reef**												
0	**Blacktip**												
3	**SHARKS TOTAL**						**0**	**3**	**0**	**0**	**0**	**0**	**0**
0	**Non-sharks**												
7	Sandbar	F	133	119	53			Y					
7	Sandbar	F	139	120	53			Y					
7	Sandbar	M	141	124	56	12		Y					
7	Sandbar	M	148	128	57	11		Y					
7	Sandbar	F	150	131	59			Y					
7	Sandbar	M	151	130	60	12		Y					
7	Sandbar	M	152	131	61	12		Y					
7	Sandbar	F	154	133	60			Y					
7	Sandbar	F	155	134	64			Y					
7	Sandbar	M	156	135	61	13		Y					
7	Sandbar	M	158	137	62	13		Y					
7	Sandbar	M	158	138	62	12		Y					
7	Sandbar	F	160	138	62			Y					
7	Sandbar	M	164	143	66	13		Y					
7	Sandbar	M	164	143	66	12		Y					
7	Sandbar	F	164	143	64			Y					
7	Sandbar	F	165	143	63			Y					
7	Sandbar	F	165	143	67			Y					
7	Sandbar	F	171	146	69			Y					
7	Sandbar	F	174	151	71			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
7	Sandbar	F	176	153	70			Y					
7	Sandbar										Y		
7	Sandbar										Y		
7	Sandbar										Y		
7	Sandbar										Y		
7	Galapagos	F	182	157	63			Y					
7	Galapagos	F	249	218	92			Y					
7	Galapagos										Y		
7	Tiger	F	174	149	64			Y					
7	Tiger	F	207	174	73			Y					
7	Tiger	M	345	306	135	23		Y					
7	Tiger						Y						
7	Grey reef	M	150	134	54	12		Y					
7	Blacktip	M	184	157	64			Y					
7	Blacktip	M	185	156	63	13		Y					
7	Moray eel							Y					
7	Moray eel							Y					
Set 7 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
25	**Sandbar**	**57**	**157**	**136**	**62**	**12**	**0**	**21**	**0**	**0**	**4**	**0**	**0**
3	**Galapagos**	**100**	**216**	**188**	**78**		**0**	**2**	**0**	**0**	**1**	**0**	**0**
4	**Tiger**	**67**	**242**	**210**	**91**	**23**	**1**	**3**	**0**	**0**	**0**	**0**	**0**
1	**Grey reef**	**0**	**150**	**134**	**54**	**12**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
2	**Blacktip**	**0**	**185**	**157**	**64**	**13**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
35	**SHARKS TOTAL**						**1**	**29**	**0**	**0**	**5**	**0**	**0**
2	**Non-sharks**						**0**	**2**	**0**	**0**	**0**	**0**	**0**
8	Sandbar	M	129	113	50	4		Y					
8	Sandbar	F	131	116	53			Y					
8	Sandbar	M	135	116	54	4		Y					
8	Sandbar	M	136	120	55	6		Y					
8	Sandbar	F	141	126	57			Y					
8	Sandbar	F	142	123	57			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
8	Sandbar	F	145	127	58			Y					
8	Sandbar	M	147	128	57	13		Y					
8	Sandbar	F	147	130	59			Y					
8	Sandbar	M	148	131	60	12		Y					
8	Sandbar	M	148	131	59	13		Y					
8	Sandbar	M	148	130	60	13		Y					
8	Sandbar	F	148	130	59			Y					
8	Sandbar	M	149	133	59	12		Y					
8	Sandbar	M	150	133	60	13		Y					
8	Sandbar	M	152	134	63	12		Y					
8	Sandbar	M	152	132	60	14		Y					
8	Sandbar	M	153	134	61	13		Y					
8	Sandbar	M	153	134	61	13		Y					
8	Sandbar	F	153	132	62			Y					
8	Sandbar	F	153	134	60			Y					
8	Sandbar	F	153	134	61			Y					
8	Sandbar	F	153	134	62			Y					
8	Sandbar	F	154	134	64			Y					
8	Sandbar	F	155	136	61			Y					
8	Sandbar	M	156	137	63	13		Y					
8	Sandbar	M	156	138	62	13		Y					
8	Sandbar	F	158	138	63			Y					
8	Sandbar	M	159	140	63	12		Y					
8	Sandbar	M	160	138	64	13		Y					
8	Sandbar	F	163	144	68			Y					
8	Sandbar	M	168	145	68	13		Y					
8	Sandbar	F	169	150	70			Y					
8	Sandbar	F	169	148	67			Y					
8	Sandbar	F	170	151	72			Y					
8	Sandbar	F	170	151	71			Y					
8	Sandbar	F	170	150	70			Y					
8	Sandbar	F	171	149	70			Y					
8	Sandbar	F	175	152	67			Y					
8	Sandbar	F	177	152	71			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
8	Sandbar	F	180	156	74			Y					
8	Sandbar										Y		
8	Sandbar										Y		
8	Sandbar										Y		
8	Sandbar										Y		
8	Sandbar										Y		
8	Sandbar										Y		
8	Sandbar										Y		
8	Galapagos	F	87	79	31			Y					
8	Galapagos	F	236	204	82	82		Y					
8	Galapagos										Y		
8	Galapagos										Y		
8	Galapagos										Y		
8	Galapagos										Y		
8	Galapagos										Y		
8	Tiger	M	84	68	25	1							Y
8	Tiger	F	242	220	93			Y					
8	Tiger	M	264	237	101	16		Y					
8	Tiger	F	266	228	97			Y					
8	Tiger	M	353	314	133	22		Y					
8	Tiger	M	354	304	130	23		Y					
8	Tiger						Y						
8	Tiger						Y						
8	Grey reef										Y		
8	Coral, unidentified									Y			
8	Coral, unidentified									Y			
8	Hapu'upu'u									Y			

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
Set 8 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
48	**Sandbar**	**56**	**155**	**136**	**62**	**11**	**0**	**41**	**0**	**0**	**7**	**0**	**0**
7	**Galapagos**	**100**	**162**	**142**	**57**	**82**	**0**	**2**	**0**	**0**	**5**	**0**	**0**
8	**Tiger**	**33**	**261**	**229**	**97**	**16**	**2**	**5**	**0**	**0**	**0**	**0**	**1**
1	**Grey reef**						**0**	**0**	**0**	**0**	**1**	**0**	**0**
0	**Blacktip**												
64	**SHARKS TOTAL**						**2**	**48**	**0**	**0**	**13**	**0**	**1**
3	**Non-sharks**						**0**	**0**	**0**	**3**	**0**	**0**	**0**
9	Sandbar	M	133	116	52	6		Y					
9	Sandbar	F	136	122	57			Y					
9	Sandbar	F	138	122	55			Y					
9	Sandbar	M	142	124	55	8		Y					
9	Sandbar	F	143	126	58			Y					
9	Sandbar	F	145	126	57			Y					
9	Sandbar	F	147	130	59			Y					
9	Sandbar	F	148	129	58			Y					
9	Sandbar	F	149	131	60			Y					
9	Sandbar	M	150	131	58	12		Y					
9	Sandbar	F	151	134	58			Y					
9	Sandbar	F	152	133	61			Y					
9	Sandbar	M	153	134	59	13		Y					
9	Sandbar	M	154	135	60	13		Y					
9	Sandbar	M	154	137	62	13		Y					
9	Sandbar	M	157	139	62	13		Y					
9	Sandbar	M	157	140	64	13		Y					
9	Sandbar	F	157	138	62			Y					
9	Sandbar	M	158	141	63	13		Y					
9	Sandbar	M	158	139	64	12		Y					
9	Sandbar	M	159	140	83	13		Y					
9	Sandbar	F	159	142	65			Y					
9	Sandbar	F	161	143	66			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
9	Sandbar	F	161	140	63			Y					
9	Sandbar	M	162	144	65	13		Y					
9	Sandbar	F	162	143	66			Y					
9	Sandbar	F	165	146	67			Y					
9	Sandbar	F	165	147	67			Y					
9	Sandbar	F	169	147	65			Y					
9	Sandbar	F	173	154	72			Y					
9	Sandbar	F	175	153	71			Y					
9	Sandbar										Y		
9	Sandbar										Y		
9	Sandbar						Y						
9	Sandbar						Y						
9	Sandbar										Y		
9	Galapagos	M	167	158	64	4		Y					
9	Galapagos	F	175	151	63			Y					
9	Galapagos	F	180	156	62			Y					
9	Galapagos	M	182	157	63	4		Y					
9	Galapagos	M	185	161	65	5		Y					
9	Galapagos	M	187	161	67	5		Y					
9	Galapagos	F	195	169	69			Y					
9	Galapagos	M	200	168	68	7		Y					
9	Galapagos	M	200	168	70	8		Y					
9	Galapagos	F	200	173	70			Y					
9	Galapagos	F	202	174	72			Y					
9	Galapagos	M	210	177	72	18		Y					
9	Galapagos	F	232	189	78			Y					
9	Galapagos	F	238	202	83			Y					
9	Galapagos	F	243	199	84			Y					
9	Galapagos	F	250	214	86			Y					
9	Galapagos										Y		
9	Tiger	M	88	71	28	2		Y					
9	Tiger	F	89	69	29							Y	
9	Tiger	M	122	100	41	2							Y
9	Tiger	F	176	147	60			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
9	Tiger	M	349	298	127	25		Y					
9	Tiger	F	350	308	132			Y					
9	Tiger	M	353	307	132	24		Y					
9	Tiger	F	357	334	141			Y					
9	Tiger	F	363	328	142			Y					
9	Tiger	F	364	312	137			Y					
9	Tiger										Y		
9	Tiger										Y		
9	Uku												
Set 9 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
36	**Sandbar**	**61**	**155**	**136**	**62**	**12**	**2**	**31**	**0**	**0**	**3**	**0**	**0**
17	**Galapagos**	**56**	**203**	**174**	**71**	**7**	**0**	**16**	**0**	**0**	**1**	**0**	**0**
11	**Tiger**	**60**	**261**	**227**	**97**	**13**	**0**	**8**	**0**	**0**	**1**	**1**	**1**
0	**Grey reef**												
0	**Blacktip**												
64	**SHARKS TOTAL**						**2**	**55**	**0**	**0**	**5**	**1**	**1**
1	**Non-sharks**						**0**	**0**	**0**	**0**	**1**	**0**	**0**
10	Sandbar	M	136	117	54	7		Y					
10	Sandbar	F	138	122	53			Y					
10	Sandbar	M	139	123	56	12		Y					
10	Sandbar	M	142	128	58	12		Y					
10	Sandbar	M	143	129	57	12		Y					
10	Sandbar	F	143	125	57			Y					
10	Sandbar	M	144	127	56	12		Y					
10	Sandbar	M	144	129	59	12		Y					
10	Sandbar	M	145	129	57	12		Y					
10	Sandbar	M	148	132	60	12		Y					
10	Sandbar	M	148	132	60	13		Y					
10	Sandbar	M	150	134	59	13		Y					
10	Sandbar	M	150	134	62	13		Y					
10	Sandbar	M	150	133	61	12		Y					
10	Sandbar	F	150	132	59			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
10	Sandbar	F	150	131	57			Y					
10	Sandbar	M	152	134	60	13		Y					
10	Sandbar	M	153	135	61	13		Y					
10	Sandbar	F	154	138	61			Y					
10	Sandbar	M	155	137	61	13		Y					
10	Sandbar	M	155	134	60	13		Y					
10	Sandbar	F	155	139	62			Y					
10	Sandbar	M	156	136	62	12		Y					
10	Sandbar	M	158	140	65	12		Y					
10	Sandbar	M	159	142	64	13		Y					
10	Sandbar	M	160	143	66	14		Y					
10	Sandbar	M	160	139	64	13		Y					
10	Sandbar	F	160	141	65			Y					
10	Sandbar	F	162	145	68			Y					
10	Sandbar	F	163	145	68			Y					
10	Sandbar	F	165	147	69			Y					
10	Sandbar	F	169	148	70			Y					
10	Sandbar	F	170	151	69			Y					
10	Sandbar	F	170	149	69			Y					
10	Sandbar	F	172	151	71			Y					
10	Sandbar	F	174	150	68			Y					
10	Sandbar	M	178	155	63	12		Y					
10	Sandbar										Y		
10	Sandbar										Y		
10	Sandbar										Y		
10	Galapagos	F	173	150	60			Y					
10	Galapagos	M	186	162	66	8		Y					
10	Galapagos	M	187	156	64	6		Y					
10	Galapagos	F	188	164	66			Y					
10	Galapagos	M	192	163	67	7		Y					
10	Galapagos	M	192	167	69	7		Y					
10	Galapagos	M	193	166	67	6		Y					
10	Galapagos	M	194	167	68	7		Y					
10	Galapagos	F	198	167	65			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
10	Galapagos	F	199	171	68			Y					
10	Galapagos	M	205	167	77	18		Y					
10	Galapagos	M	214	178	73	17		Y					
10	Galapagos	F	226	186	76			Y					
10	Galapagos	F	227	188	76			Y					
10	Galapagos	F	229	193	79			Y					
10	Galapagos	F	242	207	86			Y					
10	Galapagos	M	247	212	87	19		Y					
10	Galapagos	F	257	229	96			Y					
10	Tiger	F	390	334	142			Y					
10	Grey reef	M	112	99	37	3		Y					
10	Grey reef	M	146	133	52	11		Y					
10	Grey reef	M	158	140	56	12		Y					
10	Blacktip	M	186	160	64	14		Y					
Set 10 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
40	**Sandbar**	**41**	**155**	**137**	**62**	**12**	**0**	**37**	**0**	**0**	**3**	**0**	**0**
18	**Galapagos**	**50**	**208**	**177**	**73**	**11**	**0**	**18**	**0**	**0**	**0**	**0**	**0**
1	**Tiger**	**100**	**390**	**334**	**142**		**0**	**1**	**0**	**0**	**0**	**0**	**0**
3	**Grey reef**	**0**	**139**	**124**	**48**	**9**	**0**	**3**	**0**	**0**	**0**	**0**	**0**
1	**Blacktip**	**0**	**186**	**160**	**64**	**14**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
63	**SHARKS TOTAL**						**0**	**60**	**0**	**0**	**3**	**0**	**0**
0	**Non-sharks**												
11	Sandbar	M	132	117	52	5		Y					
11	Sandbar	F	133	119	53			Y					
11	Sandbar	M	136	119	54	4		Y					
11	Sandbar	M	140	123	56	12		Y					
11	Sandbar	M	141	126	58	12		Y					
11	Sandbar	M	142	126	58	13		Y					
11	Sandbar	M	145	129	61	12		Y					
11	Sandbar	F	146	129	59			Y					
11	Sandbar	M	148	129	60	12		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
11	Sandbar	M	148	130	61	12		Y					
11	Sandbar	M	148	132	62	12		Y					
11	Sandbar	F	149	131	61			Y					
11	Sandbar	M	150	134	61	13		Y					
11	Sandbar	M	150	131	61	13		Y					
11	Sandbar	F	151	133	61			Y					
11	Sandbar	M	153	135	60	12		Y					
11	Sandbar	F	153	135	61			Y					
11	Sandbar	M	154	135	61	13		Y					
11	Sandbar	M	154	135	62	13		Y					
11	Sandbar	F	154	135	60			Y					
11	Sandbar	M	155	137	63	12		Y					
11	Sandbar	M	155	137	63	12		Y					
11	Sandbar	M	155	137	63	12		Y					
11	Sandbar	M	156	138	62	12		Y					
11	Sandbar	F	156	144	66			Y					
11	Sandbar	M	160	140	64	13		Y					
11	Sandbar	M	160	142	66	13		Y					
11	Sandbar	F	161	143	66			Y					
11	Sandbar	F	164	145	67			Y					
11	Sandbar	F	168	149	71			Y					
11	Sandbar	F	171	152	70			Y					
11	Sandbar	F	176	155	74			Y					
11	Sandbar										Y		
11	Sandbar						Y						
11	Galapagos	M	86	73	30	1		Y					
11	Galapagos	M	150	131	52	3		Y					
11	Galapagos	F	177	150	62			Y					
11	Galapagos	M	179	155	62	6		Y					
11	Galapagos	M	185	164	66	7		Y					
11	Galapagos	F	189	165	66			Y					
11	Galapagos	M	192	167	68	5		Y					
11	Galapagos	F	192	168	69			Y					
11	Galapagos	F	197	171	69			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
11	Galapagos	M	197	169	68	10		Y					
11	Galapagos	M	197	170	69	8		Y					
11	Galapagos	F	252	220	89			Y					
11	Galapagos										Y		
11	Galapagos						Y						
11	Tiger	M	145	126	52	3							Y
11	Tiger	F	162	136	58			Y					
11	Tiger	F	342	296	131			Y					
11	Tiger	F	410	359	151			Y					
11	Tiger						Y						
11	Grey reef	M	153	138	53	11		Y					
11	Grey reef	M	159	142	55	13		Y					
11	Blacktip	M	190	163	68	13		Y					
11	Kokala									Y			
Set 11 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
34	**Sandbar**	**37**	**152**	**134**	**62**	**12**	**1**	**32**	**0**	**0**	**1**	**0**	**0**
14	**Galapagos**	**42**	**183**	**159**	**64**	**6**	**1**	**12**	**0**	**0**	**1**	**0**	**0**
5	**Tiger**	**75**	**265**	**229**	**98**	**3**	**1**	**3**	**0**	**0**	**0**	**0**	**1**
2	**Grey reef**	**0**	**156**	**140**	**54**	**12**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
1	**Blacktip**	**0**	**190**	**163**	**68**	**13**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
56	**SHARKS TOTAL**						**3**	**50**	**0**	**0**	**2**	**0**	**1**
1	**Non-sharks**						**0**	**0**	**0**	**1**	**0**	**0**	**0**
12	Sandbar	M	122	107	48	3		Y					
12	Sandbar	M	128	112	50	4		Y					
12	Sandbar	F	129	115	51			Y					
12	Sandbar	M	131	116	53	4		Y					
12	Sandbar	M	137	120	54	4		Y					
12	Sandbar	M	138	119	55	7		Y					
12	Sandbar	M	140	120	54	12		Y					
12	Sandbar	F	140	122	55			Y					
12	Sandbar	F	140	121	56			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
12	Sandbar	M	142	124	57	12		Y					
12	Sandbar	M	143	125	54	12		Y					
12	Sandbar	F	143	126	57			Y					
12	Sandbar	M	146	128	59	12		Y					
12	Sandbar	M	146	124	57	5		Y					
12	Sandbar	M	147	130	61	12		Y					
12	Sandbar	M	147	128	59	13		Y					
12	Sandbar	M	147	127	59	12		Y					
12	Sandbar	F	147	129	60			Y					
12	Sandbar	M	148	130	59	12		Y					
12	Sandbar	M	148	130	58	13		Y					
12	Sandbar	M	150	132	61	12		Y					
12	Sandbar	M	150	131	57	12		Y					
12	Sandbar	M	151	133	61	13		Y					
12	Sandbar	M	151	132	63	13		Y					
12	Sandbar	F	151	132	83			Y					
12	Sandbar	M	153	134	61	13		Y					
12	Sandbar	F	153	133	62			Y					
12	Sandbar	M	154	135	63	13		Y					
12	Sandbar	M	154	134	60	12		Y					
12	Sandbar	M	155	137	62	13		Y					
12	Sandbar	M	155	133	60	13		Y					
12	Sandbar	F	155	135	63			Y					
12	Sandbar	M	156	136	62	13		Y					
12	Sandbar	M	158	140	64	12		Y					
12	Sandbar	M	158	140	62	13		Y					
12	Sandbar	M	158	137	63	13		Y					
12	Sandbar	M	158	138	63	13		Y					
12	Sandbar	F	159	147	68			Y					
12	Sandbar	M	160	140	67	13		Y					
12	Sandbar	M	160	138	64	13		Y					
12	Sandbar	F	160	141	66			Y					
12	Sandbar	M	161	141	67	14		Y					
12	Sandbar	M	162	140	64	13		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
12	Sandbar	F	167	146	66			Y					
12	Sandbar	F	168	147	70			Y					
12	Sandbar	F	173	151	71			Y					
12	Sandbar	F	174	151	71			Y					
12	Sandbar	M				13			Y				
12	Sandbar										Y		
12	Sandbar										Y		
12	Sandbar										Y		
12	Galapagos	M	85	74	30	1		Y					
12	Galapagos	M	123	107	43	2		Y					
12	Galapagos	F	124	106	43			Y					
12	Galapagos	M	135	116	49	2		Y					
12	Galapagos	M	139	120	47	2		Y					
12	Galapagos	M	152	136	56	3		Y					
12	Galapagos	M	163	140	57	3		Y					
12	Galapagos	M	190	163	67	5		Y					
12	Galapagos	F	192	164	68			Y					
12	Galapagos	F	193	164	67			Y					
12	Galapagos	F	199	171	68			Y					
12	Galapagos	F	199	170	69			Y					
12	Galapagos	M	207	175	73	7		Y					
12	Galapagos	F	209	172	72			Y					
12	Galapagos	M	216	178	73	18		Y					
12	Galapagos	F	219	183	75			Y					
12	Galapagos	M	247	204	86	20		Y					
12	Galapagos	F	250	214	90			Y					
12	Galapagos	M	260	220	83	18		Y					
12	Galapagos										Y		
12	Galapagos										Y		
12	Galapagos										Y		
12	Galapagos										Y		
12	Tiger	F	273	226	95			Y					
12	Tiger	F	310	264	113			Y					
12	Tiger						Y						

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
12	Tiger						Y						
12	Grey reef	M	146	131	52	12		Y					
12	Grey reef	M	147	133	53	12		Y					
12	Grey reef	M	152	135	53	12		Y					
12	Grey reef	F	157	139	55			Y					
12	Grey reef										Y		
12	Blacktip	F	213	177	74			Y					
12	Sea star									Y			
12	Sea star									Y			
12	Uku										Y		
Set 12 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
51	**Sandbar**	**29**	**150**	**132**	**61**	**11**	**0**	**47**	**1**	**0**	**3**	**0**	**0**
23	**Galapagos**	**42**	**184**	**157**	**64**	**7**	**0**	**19**	**0**	**0**	**4**	**0**	**0**
4	**Tiger**	**100**	**292**	**245**	**104**		**2**	**2**	**0**	**0**	**0**	**0**	**0**
5	**Grey reef**	**25**	**151**	**135**	**53**	**12**	**0**	**4**	**0**	**0**	**1**	**0**	**0**
1	**Blacktip**	**100**	**213**	**177**	**74**		**0**	**1**	**0**	**0**	**0**	**0**	**0**
84	**SHARKS TOTAL**						**2**	**73**	**1**	**0**	**8**	**0**	**0**
3	**Non-sharks**						**0**	**0**	**0**	**2**	**1**	**0**	**0**
13	Sandbar	F	140	121	56			Y					
13	Sandbar	F	144	125	56			Y					
13	Sandbar	M	147	128	60	13		Y					
13	Sandbar	M	151	132	61	12		Y					
13	Sandbar	F	152	131	61			Y					
13	Sandbar	M	153	135	61	12		Y					
13	Sandbar	M	156	136	63	13		Y					
13	Galapagos	M	181	154	62	4		Y					
13	Galapagos	M	251	213	87	19		Y					
13	Galapagos										Y		
13	Sea star									Y			
13	Sea star									Y			
13	Uku									Y			

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
Set 13 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
7	**Sandbar**	**43**	**149**	**130**	**60**	**13**	**0**	**7**	**0**	**0**	**0**	**0**	**0**
3	**Galapagos**	**0**	**216**	**184**	**75**	**12**	**0**	**2**	**0**	**0**	**1**	**0**	**0**
0	**Tiger**												
0	**Grey reef**												
0	**Blacktip**												
10	**SHARKS TOTAL**						**0**	**9**	**0**	**0**	**1**	**0**	**0**
3	**Non-sharks**						**0**	**0**	**0**	**3**	**0**	**0**	**0**
14	Sandbar	M	127	110	51	6		Y					
14	Sandbar	F	138	120	56			Y					
14	Sandbar	F	140	121	55			Y					
14	Sandbar	M	141	122	56	12		Y					
14	Sandbar	M	142	123	56	12		Y					
14	Sandbar	F	142	122	57			Y					
14	Sandbar	M	144	125	58			Y					
14	Sandbar	M	144	124	57	12		Y					
14	Sandbar	F	145	126	58			Y					
14	Sandbar	M	148	134	64	13		Y					
14	Sandbar	M	148	128	60	12		Y					
14	Sandbar	F	148	127	58			Y					
14	Sandbar	F	148	128	58			Y					
14	Sandbar	M	151	133	60	12		Y					
14	Sandbar	F	151	131	61			Y					
14	Sandbar	M	152	132	62	13		Y					
14	Sandbar	M	152	133	63	12		Y					
14	Sandbar	F	152	132	60			Y					
14	Sandbar	F	152	131	61			Y					
14	Sandbar	M	153	134	63	12		Y					
14	Sandbar	M	153	133	62	13		Y					
14	Sandbar	F	153	133	60			Y					
14	Sandbar	M	154	132	62	13		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
14	Sandbar	F	154	135	62			Y					
14	Sandbar	M	155	135	64	13		Y					
14	Sandbar	F	155	136	64			Y					
14	Sandbar	F	156	133	63			Y					
14	Sandbar	F	156	137	63			Y					
14	Sandbar	F	158	136	63			Y					
14	Sandbar	M	162	142	65	13		Y					
14	Sandbar	F	162	142	68			Y					
14	Sandbar	F	162	140	65			Y					
14	Sandbar	F	165	143	66			Y					
14	Sandbar	F	166	145	65			Y					
14	Sandbar	F	169	146	68			Y					
14	Sandbar	F	169	146	67			Y					
14	Sandbar	F	172	151	69			Y					
14	Sandbar	F	172	146	70			Y					
14	Sandbar	F	173	150	70			Y					
14	Sandbar	F	178	155	71			Y					
14	Sandbar	F	179	155	74			Y					
14	Sandbar	F	180	158	76			Y					
14	Sandbar						Y						
14	Sandbar						Y						
14	Galapagos	M	200	170	68	7		Y					
14	Galapagos	M	202	173	71	13		Y					
14	Galapagos	F	261	222	93			Y					
14	Galapagos	F	273	231	94			Y					
14	Galapagos										Y		
14	Galapagos						Y						
14	Tiger	F	205	178	73			Y					
14	Tiger	F	246	200	86			Y					
14	Tiger	F	405	350	151			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
Set 14 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
44	**Sandbar**	**64**	**155**	**135**	**63**	**12**	**2**	**42**	**0**	**0**	**0**	**0**	**0**
6	**Galapagos**	**50**	**234**	**199**	**82**	**10**	**1**	**4**	**0**	**0**	**1**	**0**	**0**
3	**Tiger**	**100**	**285**	**243**	**103**		**0**	**3**	**0**	**0**	**0**	**0**	**0**
0	**Grey reef**												
0	**Blacktip**												
53	**SHARKS TOTAL**						**3**	**49**	**0**	**0**	**1**	**0**	**0**
0	**Non-sharks**												
15	Sandbar	F	133	116	50			Y					
15	Sandbar	F	133	114	52			Y					
15	Sandbar	F	133	116	55			Y					
15	Sandbar	M	134	115	54	6		Y					
15	Sandbar	M	134	127	61	12		Y					
15	Sandbar	F	134	116	52			Y					
15	Sandbar	M	136	118	55	12		Y					
15	Sandbar	F	136	118	53			Y					
15	Sandbar	M	137	116	56	9		Y					
15	Sandbar	M	137	121	53	9		Y					
15	Sandbar	F	138	118	54			Y					
15	Sandbar	F	139	119	53			Y					
15	Sandbar	M	140	120	55	8		Y					
15	Sandbar	F	141	122	56			Y					
15	Sandbar	M	143	125	57	12		Y					
15	Sandbar	M	144	124	57	8		Y					
15	Sandbar	M	144	124	57	11		Y					
15	Sandbar	M	145	126	58	13		Y					
15	Sandbar	M	146	125	55	8		Y					
15	Sandbar	M	147	127	58	13		Y					
15	Sandbar	M	147	127	57	13		Y					
15	Sandbar	M	147	126	59	12		Y					
15	Sandbar	M	147	126	57	13		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
15	Sandbar	M	148	130	60	11		Y					
15	Sandbar	F	148	128	58			Y					
15	Sandbar	M	149	129	58	13		Y					
15	Sandbar	M	150	127	58	12		Y					
15	Sandbar	M	150	132	60	13		Y					
15	Sandbar	M	151	132	62	13		Y					
15	Sandbar	M	152	132	62	12		Y					
15	Sandbar	F	152	131	61			Y					
15	Sandbar	M	154	133	63	13		Y					
15	Sandbar	M	155	134	60	13		Y					
15	Sandbar	F	155	132	61			Y					
15	Sandbar	F	155	135	63			Y					
15	Sandbar	M	156	135	61	13		Y					
15	Sandbar	M	160	137	62	13		Y					
15	Sandbar	F	161	141	68			Y					
15	Sandbar	F	161	139	65			Y					
15	Sandbar	M	162	141	65	14		Y					
15	Sandbar	F	163	141	65			Y					
15	Sandbar	M	164	141	64	13		Y					
15	Sandbar	F	165	142	65			Y					
15	Sandbar	F	165	142	68			Y					
15	Sandbar	F	165	141	65			Y					
15	Sandbar	F	169	145	66			Y					
15	Sandbar	F	169	148	68			Y					
15	Sandbar	F	174	150	69			Y					
15	Sandbar	F	175	150	70			Y					
15	Sandbar	F	181	155	71			Y					
15	Galapagos	F	188	158	66			Y					
15	Galapagos	F	202	172	70			Y					
15	Galapagos	M	226	175	74	15		Y					
15	Galapagos	M	237	196	83	18		Y					
15	Kahala										Y		
15	Kona crab									Y			
15	Uku										Y		

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
15	Uku										Y		
15	Uku										Y		
Set 15 summary (Gardner Pinnacles)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
50	**Sandbar**	**46**	**150**	**130**	**60**	**12**	**0**	**50**	**0**	**0**	**0**	**0**	**0**
4	**Galapagos**	**50**	**213**	**175**	**73**	**17**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
0	**Tiger**												
0	**Grey reef**												
0	**Blacktip**												
54	**SHARKS TOTAL**						**0**	**54**	**0**	**0**	**0**	**0**	**0**
5	**Non-sharks**						**0**	**0**	**0**	**1**	**4**	**0**	**0**
16	Sandbar	M	126	110	50	3		Y					
16	Sandbar	M	142	121	55	6		Y					
16	Sandbar	F	145	125	56			Y					
16	Sandbar	M	150	131	58	12		Y					
16	Sandbar	F	152	130	58			Y					
16	Sandbar	F	179	156	76			Y					
16	Sandbar										Y		
16	Galapagos	M	140	121	49	3		Y					
16	Galapagos	F	214	183	74			Y					
16	Galapagos	F	242	202	81			Y					
16	Galapagos	F	251	215	89			Y					
16	Galapagos										Y		
16	Galapagos										Y		
16	Galapagos										Y		
16	Tiger	F	87	66	26								Y
16	Tiger	F	213	146	88			Y					
16	Tiger	F	253	210	93			Y					
16	Tiger	F	275	226	94			Y					
16	Tiger	M	295	243	104	12		Y					
16	Tiger	M	340	286	124	22		Y					
16	Tiger	M	363	309	135	22		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
16	Tiger	M	364	306	131	23		Y					
16	Tiger	M	368	317	129	24		Y					
16	Tiger	M	397	341	142	24		Y					
16	Tiger						Y						
16	Tiger						Y						
16	Spotted eagle ray							Y					
16	Spotted eagle ray							Y					
16	Coral, unidentified									Y			
16	Coral, unidentified									Y			
16	Uku									Y			
16	Uku									Y			
16	Uku									Y			
16	Uku										Y		
16	Trevally										Y		
16	Trevally									Y			
Set 16 summary (St. Rogatien Bank)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
7	**Sandbar**	**50**	**149**	**129**	**59**	**7**	**0**	**6**	**0**	**0**	**1**	**0**	**0**
7	**Galapagos**	**75**	**212**	**180**	**73**	**3**	**0**	**4**	**0**	**0**	**3**	**0**	**0**
12	**Tiger**	**40**	**296**	**245**	**107**	**21**	**2**	**9**	**0**	**0**	**0**	**0**	**1**
0	**Grey reef**												
0	**Blacktip**												
26	**SHARKS TOTAL**						**2**	**19**	**0**	**0**	**4**	**0**	**1**
10	**Non-sharks**						**0**	**2**	**0**	**6**	**2**	**0**	**0**
17	Sandbar	M	112	98	43	3		Y					
17	Sandbar	M	124	109	48	4		Y					
17	Sandbar	M	125	108	50	6		Y					
17	Sandbar	F	126	111	52			Y					
17	Sandbar	M	127	111	49	6		Y					
17	Sandbar	M	128	112	50	4		Y					
17	Sandbar	M	131	112	49	5		Y					
17	Sandbar	F	132	112	50			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
17	Sandbar	F	133	114	53			Y					
17	Sandbar	M	134	117	54	6		Y					
17	Sandbar	M	135	116	55	12		Y					
17	Sandbar	F	135	117	52			Y					
17	Sandbar	M	136	117	57	7		Y					
17	Sandbar	M	138	119	55	12		Y					
17	Sandbar	M	138	119	54	7		Y					
17	Sandbar	M	139	121	54	5		Y					
17	Sandbar	M	139	119	53	10		Y					
17	Sandbar	M	139	120	55	12		Y					
17	Sandbar	M	139	120	55	6		Y					
17	Sandbar	F	139	121	55			Y					
17	Sandbar	M	140	122	54	12		Y					
17	Sandbar	F	140	122	56			Y					
17	Sandbar	F	140	123	56			Y					
17	Sandbar	M	141	121	55	6		Y					
17	Sandbar	M	142	124	59	13		Y					
17	Sandbar	M	142	123	57	10		Y					
17	Sandbar	M	142	123	54	12		Y					
17	Sandbar	F	143	124	56			Y					
17	Sandbar	F	143	125	56			Y					
17	Sandbar	M	144	126	58	10		Y					
17	Sandbar	M	144	124	57	13		Y					
17	Sandbar	M	144	125	56	12		Y					
17	Sandbar	M	144	125	56	11		Y					
17	Sandbar	F	144	124	56			Y					
17	Sandbar	M	145	126	55	13		Y					
17	Sandbar	M	145	127	58	12		Y					
17	Sandbar	M	145	125	56	10		Y					
17	Sandbar	F	145	127	57			Y					
17	Sandbar	F	145	126	57			Y					
17	Sandbar	M	146	126	57	12		Y					
17	Sandbar	M	146	126	58	13		Y					
17	Sandbar	M	146	126	57	13		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
17	Sandbar	M	146	132	62	13		Y					
17	Sandbar	M	146	127	58	9		Y					
17	Sandbar	M	146	128	60	12		Y					
17	Sandbar	M	146	125	58	12		Y					
17	Sandbar	F	146	126	56			Y					
17	Sandbar	M	147	126	57	12		Y					
17	Sandbar	M	147	125	56	12		Y					
17	Sandbar	M	147	126	59	13		Y					
17	Sandbar	M	147	125	57	12		Y					
17	Sandbar	F	147	126	56			Y					
17	Sandbar	M	148	127	58	12		Y					
17	Sandbar	M	148	127	59	12		Y					
17	Sandbar	M	148	128	57	12		Y					
17	Sandbar	M	148	128	58	11		Y					
17	Sandbar	M	148	128	59	13		Y					
17	Sandbar	M	148	129	58	13		Y					
17	Sandbar		148	129	56			Y					
17	Sandbar	M	149	127	58	13		Y					
17	Sandbar	M	149	129	59	12		Y					
17	Sandbar	M	149	130	59	13		Y					
17	Sandbar	M	149	129	58	13		Y					
17	Sandbar	M	150	130	60	11		Y					
17	Sandbar	M	150	128	58	13		Y					
17	Sandbar	M	150	128	56	13		Y					
17	Sandbar	M	150	128	60	12		Y					
17	Sandbar	F	150	131	61			Y					
17	Sandbar	F	150	131	61			Y					
17	Sandbar	F	150	128	58			Y					
17	Sandbar	F	151	131	61			Y					
17	Sandbar	F	151	131	58			Y					
17	Sandbar	F	151	129	58			Y					
17	Sandbar	M	152	133	60	12		Y					
17	Sandbar	M	152	130	60	12		Y					
17	Sandbar	M	152	130	58	12		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
17	Sandbar	F	152	130	61			Y					
17	Sandbar	F	152	131	59			Y					
17	Sandbar	M	153	132	60	12		Y					
17	Sandbar	M	153	136	62	12		Y					
17	Sandbar	M	154	133	60	13		Y					
17	Sandbar	M	154	132	59	14		Y					
17	Sandbar	M	154	132	61	13		Y					
17	Sandbar	M	154	135	62	13		Y					
17	Sandbar	M	155	134	61	13		Y					
17	Sandbar	M	155	135	64	13		Y					
17	Sandbar	M	155	133	59	14		Y					
17	Sandbar	M	155	134	58	13		Y					
17	Sandbar	M	156	136	61	12		Y					
17	Sandbar	M	156	134	62	12		Y					
17	Sandbar	M	157	136	63	13		Y					
17	Sandbar	M	158	139	63	12		Y					
17	Sandbar	M	158	137	62	12		Y					
17	Sandbar	M	158	137	63	13		Y					
17	Sandbar	M	159	138	63	12		Y					
17	Sandbar	M	159	138	65	12		Y					
17	Sandbar	F	160	138	63			Y					
17	Sandbar	F	160	137	63			Y					
17	Sandbar	M	162	138	63	13		Y					
17	Sandbar	M	164	143	66	14		Y					
17	Sandbar	M	165	142	63	13		Y					
17	Sandbar	F	165	142	65			Y					
17	Sandbar	F	166	142	65			Y					
17	Sandbar	F	166	146	69			Y					
17	Sandbar	F	167	143	67			Y					
17	Sandbar	F	170	146	67			Y					
17	Sandbar	F	172	147	69			Y					
17	Sandbar	F	172	147	68			Y					
17	Sandbar										Y		
17	Sandbar										Y		

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
17	Sandbar										Y		
17	Sandbar										Y		
17	Sandbar										Y		
17	Sandbar						Y						
17	Sandbar						Y						
17	Galapagos	M	85	72	29	2		Y					
17	Galapagos	M	116	102	40	2		Y					
17	Galapagos	F	116	101	40			Y					
17	Galapagos	M	120	105	43	2		Y					
17	Galapagos	M	129	111	45	3		Y					
17	Galapagos	F	136	117	48			Y					
17	Galapagos	M	184	159	62	4		Y					
17	Galapagos	M	184	157	65	3		Y					
17	Galapagos	F	199	169	67			Y					
17	Galapagos	F	240		81				Y				
17	Galapagos	M	247	210	87	20		Y					
17	Tiger	F	88	69	27								Y
17	Tiger	M	147	122	50	3		Y					
17	Tiger	M	156	126	53	3		Y					
17	Tiger	F	195	162	69			Y					
17	Tiger	F	410	349	149			Y					
17	Tiger										Y		
17	Tiger						Y						
17	Tiger						Y						
17	Grey reef	M	137	121	47	10		Y					
17	Grey reef	M	149	132	53	12		Y					
17	Boxcrab									Y			
17	Coral, unidentified									Y			
17	Sea star									Y			
17	Sea star									Y			
17	Trevally										Y		
17	Trevally						Y						

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
Set 17 summary (St. Rogatien Bank)													
No.		% F	Ave.	Ave.	Ave.	Ave.	No.	No.	No.	No.	No.	No.	No.
115	Sandbar	29	148	128	58	11	2	108	0	0	5	0	0
11	Galapagos	36	160	130	55	5	0	10	1	0	0	0	0
8	Tiger	60	199	166	70	3	2	4	0	0	1	0	1
2	Grey reef	0	143	127	50	11	0	2	0	0	0	0	0
0	Blacktip												
136	SHARKS TOTAL						4	124	1	0	6	0	1
6	Non-sharks						1	0	0	4	1	0	0
18	Sandbar	M	134	117	53	8		Y					
18	Sandbar	F	137	120	55			Y					
18	Sandbar	F	142	123	56			Y					
18	Sandbar	M	143	125	58	14		Y					
18	Sandbar	M	152	132	61	13		Y					
18	Sandbar	F	152	131	61			Y					
18	Sandbar	F	163	143	65			Y					
18	Sandbar	F	167	143	65			Y					
18	Sandbar	F	179	153	70			Y					
18	Sandbar										Y		
18	Sandbar										Y		
18	Galapagos	F	197	168	67			Y					
18	Galapagos	M	214	179	73	19		Y					
18	Galapagos	M	235	190	82	18		Y					
18	Tiger	F	406	343	147			Y					
18	Tiger						Y						
18	Macroalgae and rock									Y			
18	Trevally										Y		

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
Set 18 summary (French Frigate Shoals)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
11	**Sandbar**	**67**	**152**	**132**	**60**	**12**	**0**	**9**	**0**	**0**	**2**	**0**	**0**
3	**Galapagos**	**33**	**215**	**179**	**74**	**19**	**0**	**3**	**0**	**0**	**0**	**0**	**0**
2	**Tiger**	**100**	**406**	**343**	**147**		**1**	**1**	**0**	**0**	**0**	**0**	**0**
0	**Grey reef**												
0	**Blacktip**												
16	**SHARKS TOTAL**						**1**	**13**	**0**	**0**	**2**	**0**	**0**
2	**Non-sharks**						**0**	**0**	**0**	**1**	**1**	**0**	**0**
19	Sandbar	M	118	102	46	2		Y					
19	Sandbar	F	120	104	47			Y					
19	Sandbar	M	121	102	47	3							Y
19	Sandbar	F	125	110	48			Y					
19	Sandbar	M	129	111	50	3		Y					
19	Sandbar	F	129	113	51			Y					
19	Sandbar	M	134	115	52	4		Y					
19	Sandbar	F	135	118	53			Y					
19	Sandbar	M	136	118	55	10		Y					
19	Sandbar	F	138	119	53			Y					
19	Sandbar	F	138	119	53			Y					
19	Sandbar	M	139	120	53	11		Y					
19	Sandbar	F	139	119	53			Y					
19	Sandbar	M	141	123	56	12		Y					
19	Sandbar	M	143	124	57	12		Y					
19	Sandbar	F	143	123	56			Y					
19	Sandbar	M	144	125	58	12		Y					
19	Sandbar	M	144	124	54	11		Y					
19	Sandbar	M	144	123	56	11		Y					
19	Sandbar	M	145	124	56	12		Y					
19	Sandbar	M	146	126	62	12		Y					
19	Sandbar	M	146	125	56	12		Y					
19	Sandbar	M	147	126	57	12		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
19	Sandbar	M	148	132	61	12		Y					
19	Sandbar	M	148	127	58	12		Y					
19	Sandbar	F	148	128	58			Y					
19	Sandbar	M	151	130	61	12		Y					
19	Sandbar	M	153	131	60	13		Y					
19	Sandbar	M	157	133	58	12		Y					
19	Sandbar	M	164	142	64	14		Y					
19	Sandbar	F	164	142	67			Y					
19	Sandbar	F	165	145	67			Y					
19	Sandbar	F	169	145	67			Y					
19	Sandbar	F	174	149	70			Y					
19	Sandbar	F	178	153	74			Y					
19	Sandbar						Y						
19	Galapagos	F	182	164	66			Y					
19	Galapagos	M	192	163	66			Y					
19	Galapagos	M	200	168	69	15		Y					
19	Galapagos	F	214	177	72			Y					
19	Galapagos	F	217	180	74			Y					
19	Galapagos	F	225	211	88			Y					
19	Galapagos	F	255	217	90			Y					
19	Galapagos						Y						
19	Tiger	F	88	66	27							Y	
19	Tiger	F	134	107	44								Y
19	Grey reef	M	147	131	50	12		Y					
19	Grey reef										Y		
19	Trevally										Y		

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
Set 19 summary (French Frigate Shoals)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
36	**Sandbar**	**40**	**145**	**125**	**57**	**10**	**1**	**34**	**0**	**0**	**0**	**0**	**1**
8	**Galapagos**	**71**	**212**	**183**	**75**	**15**	**1**	**7**	**0**	**0**	**0**	**0**	**0**
2	**Tiger**	**100**	**111**	**87**	**36**		**0**	**0**	**0**	**0**	**0**	**1**	**1**
2	**Grey reef**	**0**	**147**	**131**	**50**	**12**	**0**	**1**	**0**	**0**	**1**	**0**	**0**
0	**Blacktip**												
48	**SHARKS TOTAL**						**2**	**42**	**0**	**0**	**1**	**1**	**2**
1	**Non-sharks**						**0**	**0**	**0**	**0**	**1**	**0**	**0**
20	Sandbar	M	136	118	53	4		Y					
20	Sandbar	M	146	128	60	12		Y					
20	Sandbar	M	147	128	58	11		Y					
20	Sandbar	M	148	126	57	12		Y					
20	Sandbar	F	148	128	59			Y					
20	Sandbar	M	151	131	60	13		Y					
20	Sandbar	F	151	131	59			Y					
20	Sandbar	M	152	132	59	12		Y					
20	Sandbar	F	167	139	64			Y					
20	Galapagos	M	201	168	69	8		Y					
20	Galapagos	M	212	175	71	7		Y					
20	Galapagos	F	216	179	74			Y					
20	Galapagos										Y		
20	Galapagos						Y						
20	Tiger	M	189	155	65	4		Y					
20	Tiger	F	191	157	66			Y					
20	Tiger	F	192	159	66			Y					
20	Tiger	F	213	170	75			Y					
20	Tiger	M	239	197	83	8		Y					
20	Tiger	M	246	202	86	6		Y					
20	Tiger	M	273	225	93	10		Y					
20	Tiger						Y						
20	Grey reef	F	148	130	50			Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
20	Grey reef	M	150	133	52	11		Y					
20	Sea star									Y			
20	Sea star									Y			
20	Sea star									Y			
20	Sea star									Y			
Set 20 summary (Nihoa West-1)													
No.		**% F**	**Ave.**	**Ave.**	**Ave.**	**Ave.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**	**No.**
9	**Sandbar**	**33**	**150**	**129**	**59**	**11**	**0**	**9**	**0**	**0**	**0**	**0**	**0**
5	**Galapagos**	**33**	**210**	**174**	**71**	**8**	**1**	**3**	**0**	**0**	**1**	**0**	**0**
8	**Tiger**	**43**	**220**	**181**	**76**	**7**	**1**	**7**	**0**	**0**	**0**	**0**	**0**
2	**Grey reef**	**50**	**149**	**132**	**51**	**11**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
0	**Blacktip**												
24	**SHARKS TOTAL**						**2**	**21**	**0**	**0**	**1**	**0**	**0**
4	**Non-sharks**						**0**	**0**	**0**	**4**	**0**	**0**	**0**
21	Sandbar	F	125	110	50			Y					
21	Sandbar	F	127	111	51			Y					
21	Sandbar	F	130	114	51			Y					
21	Sandbar	M	143	123	56	11		Y					
21	Sandbar	M	145	125	57	13		Y					
21	Sandbar	M	147	132	59	12		Y					
21	Sandbar	M	147	127	57	13		Y					
21	Sandbar	M	149	129	59	13		Y					
21	Sandbar	M	149	129	58	11		Y					
21	Sandbar	M	150	130	61	13		Y					
21	Sandbar	M	151	132	59	13		Y					
21	Sandbar	M	151	131	60	13		Y					
21	Sandbar	M	151	132	63	13		Y					
21	Sandbar	M	152	132	60	13		Y					
21	Sandbar	F	152	133	61			Y					
21	Sandbar	M	153	132	60	12		Y					
21	Sandbar	M	153	134	61	13		Y					
21	Sandbar	M	154	132	61	13		Y					

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
21	Sandbar	M	155	134	62	12		Y					
21	Sandbar	M	156	134	62	12		Y					
21	Sandbar	M	156	137	63	13		Y					
21	Sandbar	F	157	134	61			Y					
21	Sandbar	M	157	137	62	13		Y					
21	Sandbar	M	158	137	66	13		Y					
21	Sandbar	M	158	138	62	13		Y					
21	Sandbar	M	159	137	61	13		Y					
21	Sandbar	M	163	141	63	13		Y					
21	Sandbar	F	166	146	66			Y					
21	Sandbar	M	170	148	57	12		Y					
21	Sandbar	F	173	149	70			Y					
21	Sandbar										Y		
21	Galapagos	F	229	189	78			Y					
21	Galapagos	F	229	185	76			Y					
21	Galapagos	F	233	195	81			Y					
21	Galapagos	F	246	205	83			Y					
21	Galapagos	F	255	216	88			Y					
21	Galapagos	F	265	224	92			Y					
21	Galapagos	F	268	227	94			Y					
21	Galapagos						Y						
21	Tiger	F	149	121	49			Y					
21	Tiger	F	154	127	52			Y					
21	Tiger	F	157	128	52								Y
21	Tiger	F	198	161	69			Y					
21	Uku									Y			
21	Uku									Y			

Appendix 1. Catch Details, by Set

Set no.	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 length (cm)	Clasper length (cm)	Lost	Retained		Discarded			
								not damaged	damaged	not damaged	damaged	alive tagged	alive not tagged
Set 21 summary (Nihoa West-2)													
No.		% F	Ave.	Ave.	Ave.	Ave.	No.	No.	No.	No.	No.	No.	No.
31	Sandbar	23	152	132	60	13	0	30	0	0	1	0	0
8	Galapagos	100	246	206	85		1	7	0	0	0	0	0
4	Tiger	100	165	134	56		0	3	0	0	0	0	1
0	Grey reef												
0	Blacktip												
43	SHARKS TOTAL						1	40	0	0	1	0	1
2	Non-sharks						0	0	0	2	0	0	0
TRIP SUMMARY													
No.		% F	Ave.	Ave.	Ave.	Ave.	No.	No.	No.	No.	No.	No.	No.
697	Sandbar	45	152	132	61	11	8	641	2	0	45	0	1
186	Galapagos	55	203	172	71	10	5	152	3	0	26	0	0
101	Tiger	65	257	220	96	14	16	69	0	0	3	4	9
20	Grey reef	12	148	132	52	11	0	16	0	0	4	0	0
9	Blacktip	11	191	162	67	13	0	9	0	0	0	0	0
1013	SHARKS TOTAL						29	887	5	0	78	4	10
60	Non-sharks						1	5	0	39	15	0	0

Appendix 2. Tagged Shark Information

Tag no.	Set no.	Date	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 (cm)	Clasper length (cm)
HL 1226	2	9/13/99	Tiger (pup)					
HL 1227	2	9/13/99	Tiger (pup)					
HL 1228	2	9/13/99	Tiger (pup)					
HL 1229	4	9/24/99	Tiger (pup)		84	64		
HL 1250	4	9/24/99	Tiger		115	99		
HL 1230	5	9/25/99	Tiger	M	144	120	50	3
HL 1231	8	9/28/99	Tiger	M	84	68	25	1
HL 1232	9	9/29/99	Tiger	M	122	100	41	2
HL 1233	11	10/2/99	Tiger	M	145	126	52	3
HL 1234	14	10/5/99	Tiger (pup)					
HL 1235	16	10/7/99	Tiger	F	87	66	26	
HL 1236	17	10/8/99	Tiger	F	88	69	27	
HL 1237	19	10/11/99	Tiger	F	134	107	44	
HL 1238	19	10/11/99	Sandbar	M	121	102	47	3
HL 1239	21	10/14/99	Tiger	F	157	128	52	

Tagging information cards were given to Tom Kazama, Fishery Biologist, Honolulu Laboratory, 2570 Dole St., Honolulu, HI 96822.

Appendix 3. Tissue Samples Collected for DNA Analysis

DNA Sample	Set no.	Date	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 (cm)	Clasper length (cm)
1	1	8/30/99	Galapagos	M	189	157	65	
2	1	8/30/99	Galapagos	M	191	165	66	
3	1	8/30/99	Tiger	M	354	325	158	
4	1	8/30/99	Sandbar	F	174	153	81	
5	1	8/30/99	Galapagos	F	156	133	53	
6	1	8/30/99	Galapagos	F	225	184	76	
7	1	8/30/99	Galapagos	F	139	119	47	
9	2	9/12/99	Galapagos	M	121	106	49	4
10	2	9/12/99	Galapagos	F	271	221	93	
11	2	9/12/99	Sandbar	F	167	141	66	
12	2	9/12/99	Tiger	M	356	295	125	26
13	2	9/13/99	Sandbar	M	114	98	45	4
14	2	9/13/99	Tiger	M	360	313	134	23
15	2	9/13/99	Galapagos	M	255	211	89	19
16	2	9/13/99	Blacktip	M	192	163	69	13
17	2	9/13/99	Sandbar	F	169	143	66	
18	2	9/13/99	Tiger	F	403	343	147	
19	2	9/13/99	Sandbar	F	172	148	70	
20	2	9/13/99	Tiger	F	360	320	136	
21	2	9/13/99	Tiger	F	367	337	144	
22	2	9/13/99	Tiger	F	354	303	129	
23	3	9/23/99	Galapagos	F	218	184	77	
24	3	9/23/99	Galapagos	F	227	193	81	
25	3	9/23/99	Blacktip	M	189	159	67	13
26	3	9/23/99	Blacktip	M	184	161	67	13
27	4	9/24/99	Galapagos	F	250	217	87	
28	5	9/25/99	Blacktip	M	193	166	70	14
29	5	9/25/99	Galapagos	F	236	198	80	
30	5	9/25/99	Galapagos	F	249	214	89	
31	5	9/25/99	Galapagos	F	279	216	89	
32	5	9/25/99	Grey reef	M	152	135	52	12
33	5	9/25/99	Grey reef					
34	5	9/25/99	Galapagos	M	185	159	65	4
35	5	9/25/99	Galapagos	M	184	159	65	6
36	5	9/25/99	Galapagos	F	156	133	54	
37	7	9/27/99	Blacktip	M	185	156	63	13
38	7	9/27/99	Blacktip	M	184	157	64	
39	7	9/27/99	Grey reef	M	150	134	54	12
40	8	9/28/99	Galapagos	F	236	204	82	82
41	8	9/28/99	Grey reef					
42	10	9/30/99	Blacktip	M	186	160	64	14
43	10	9/30/99	Grey reef	M	146	133	52	11
44	10	9/30/99	Grey reef	M	158	140	56	12
45	10	9/30/99	Grey reef	M	112	99	37	3
46	11	10/2/99	Galapagos	F	197	171	69	
47	11	10/2/99	Blacktip	M	190	163	68	13
48	11	10/2/99	Grey reef	M	153	138	53	11
49	12	10/3/99	Blacktip	F	213	177	74	
50	12	10/3/99	Grey reef	M	147	133	53	12
51	12	10/3/99	Grey reef					
52	17	10/8/99	Grey reef	M	149	132	53	12

Appendix 4. Liver Samples Collected

Liver Sample	Set No.	Date	Species	Sex	Total length (cm)	Fork length (cm)	D1-D2 (cm)	Clasper length (cm)
1	2	9/12/99	Tiger	M	356	295	125	26
2	2	9/13/99	Tiger	M	360	313	134	23
3	2	9/13/99	Tiger	F	360	320	136	
4	2	9/13/99	Tiger	F	367	337	144	
5	2	9/13/99	Tiger	F	354	303	129	
6	3	9/23/99	Tiger	F	260	240	102	
7	3	9/23/99	Tiger	F	260	224	97	
8	4	9/24/99	Tiger	F	340	340	144	
9	4	9/24/99	Tiger	F	249	190	78	
10	4	9/24/99	Tiger	F	198	162	65	
11	4	9/24/99	Tiger	M	305	264	116	20
12	4	9/24/99	Tiger	M	235	193	82	8
13	4	9/24/99	Tiger	F	340	302	131	
14	4	9/24/99	Tiger	F	366	326	139	
15	5	9/25/99	Tiger	F	336	320	135	
16	6	9/26/99	Tiger	F	354	316	132	
17	7	9/27/99	Tiger	F	174	149	64	
18	7	9/27/99	Tiger	M	345	306	135	23
19	7	9/27/99	Tiger	F	207	174	73	
20	8	9/28/99	Tiger	F	266	228	97	
21	8	9/28/99	Tiger	M	353	314	133	22
22	8	9/28/99	Tiger	M	264	237	101	16
23	8	9/28/99	Tiger	M	354	304	130	23
24	9	9/29/99	Tiger	M	353	307	132	24
25	9	9/29/99	Tiger	F	364	312	137	
26	9	9/29/99	Tiger	F	350	308	132	
27	9	9/29/99	Tiger	F	363	328	142	
28	9	9/29/99	Tiger	F	357	334	141	
29	9	9/29/99	Tiger	M	349	298	127	25
30	10	9/30/99	Tiger	F	390	334	142	
31	11	10/2/99	Tiger	F	342	296	131	
32	11	10/2/99	Tiger	F	410	359	151	
33	12	10/3/99	Tiger	F	310	264	113	
34	12	10/3/99	Tiger	F	273	226	95	
35	14	10/5/99	Tiger	F	205	178	73	
36	14	10/5/99	Tiger	F	405	350	151	
37	14	10/5/99	Tiger	F	246	200	86	
38	16	10/7/99	Tiger	M	364	306	131	23
39	16	10/7/99	Tiger	M	363	309	135	22
40	16	10/7/99	Tiger	F	275	226	94	
41	16	10/7/99	Tiger	M	295	243	104	12
42	16	10/7/99	Tiger	F	213	146	88	
43	16	10/7/99	Tiger	M	397	341	142	24
44	16	10/7/99	Tiger	M	368	317	129	24
45	16	10/7/99	Tiger	F	253	210	93	
46	16	10/7/99	Tiger	M	340	286	124	22
47	17	10/8/99	Tiger	F	195	162	69	
48	17	10/8/99	Tiger	F	410	349	149	
49	20	10/13/99	Tiger	M	246	202	86	6
50	20	10/13/99	Tiger	M	239	197	83	8
51	20	10/13/99	Tiger	F	213	170	75	
52	20	10/13/99	Tiger	M	273	225	93	10
53	21	10/14/99	Tiger	F	198	161	69	

Appendix 5. Counts and Sizes of Shark Embryos and Pups

Set no.	Species	No. embryos	No. pups	Condition	Total length range (cm)
2	Galapagos		8	dead	72
2	Tiger		10	alive	
2	Tiger		unknown	alive	
3	Sandbar		7	dead	67-69
3	Sandbar		3	dead	
3	Galapagos		9	dead	61-64
4	Galapagos		7	dead	59-61
4	Galapagos		5	dead	56
5	Tiger	43		dead	8-16
5	Galapagos		10	dead	61-65
5	Sandbar		5	dead	14
6	Tiger		16	alive	71
7	Sandbar	7		alive	11-16
7	Sandbar	4		dead	7-9
9	Galapagos		3	dead	46-51
9	Sandbar	4		dead	18-19
10	Galapagos		8	dead	59-61
10	Sandbar		6	dead	62-64
10	Sandbar		6	4 dead, 2 alive	59
10	Galapagos		6	dead	59
11	Sandbar	12		dead	6
11	Sandbar	6		dead	12-16
11	Sandbar	6		dead	16-17
11	Tiger		28	alive	72-78
11	Tiger	40		dead	11-12
12	Galapagos		10	dead	60-62
12	Sandbar	unknown	unknown	dead	
14	Sandbar	6		dead	8-9
14	Sandbar	6		dead	18-19
14	Sandbar	4		dead	14
14	Sandbar	6		alive	13-15
14	Sandbar	7		dead	12-13
14	Sandbar	4		dead	3-4
14	Sandbar	6		dead	16-18
14	Tiger		42	alive	82-85
14	Galapagos	6		dead	16-17
17	Sandbar	5		dead	15-16
17	Sandbar	6		dead	13-14
17	Sandbar	6		dead	20
18	Sandbar	6		dead	22-24
18	Sandbar	3		dead	14
18	Tiger	44		alive	6-8
18	Sandbar	4		dead	17-19
18	Sandbar	4		dead	21-23
19	Sandbar	5		dead	18-19
19	Sandbar	8		dead	15-16
19	Sandbar	8		dead	16-18
19	Sandbar	8		dead	12-14
19	Galapagos		8	alive	64
20	Grey reef	2	4	alive	35-37

Appendix 6. Photographs of Sharks

Figure 3. Sandbar shark, *Carcharhinus plumbeus*.

Figure 4. Galapagos shark, *Carcharhinus galapagensis*.

Figure 5. Tiger shark, *Galeocerdo cuvier*.

Figure 6. Grey reef shark, *Carcharhinus amblyrhynchos*.

Figure 7. Blacktip shark, *Carcharhinus limbatus* (left), and Galapagos shark (right).